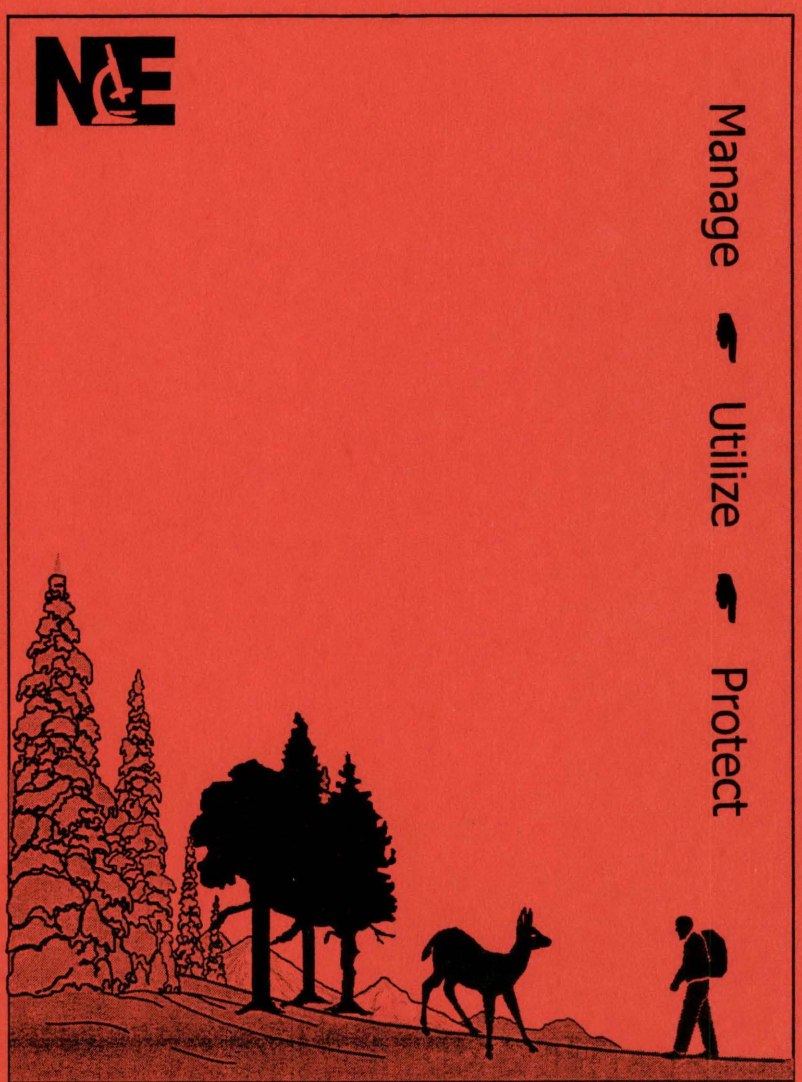
United States
Department of
Agriculture

Forest Service

Northeastern
Research Station

Research Attainment Report

Fiscal Year 1999



RESEARCH ATTAINMENT REPORT

FISCAL YEAR 1999

United States Department of Agriculture
Forest Service
Northeastern Research Station

CONTENTS

Research Work Unit Attainment Reports

Wildlife, Fish, Water, and Air Reserach (Continued)

PART I: RESEARCH WORK UNIT ATTAINMENT REPORTS

INTRODUCTION

The Research Work Unit Attainment Reports in Part I each begin with a Research Work Unit Summary. This summary is in the form of a table, listing the problem number and title, the current level of funding, the current staffing (scientist years) and a tally of the number of publications produced, whether in the work unit, through extramural research, or through cooperative research.

The Research Work Unit Summary is followed by further information for each problem giving the attainments for a single problem. These reports give bibliographic information on each publication resulting from the research on a particular problem, plus a narrative summary of the attainment for that problem.

Part II is a bibliography of all the publications produced as a result of research conducted by the Northeastern Research Station in Fiscal Year 1999, listed in alphabetical order.

4103 The Role of Environmental Stress on Tree Growth and Development
Tyree, Melvin T, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Measure physiological performance of trees following stress and evaluate mechanisms leading to health declines	510	2	0	0	2
2. Towards a better understanding of water-stress physiology: hydraulic sufficiency of stems to conduct water to leaves	360	1	4	0	4

4103 The Role of Environmental Stress on Tree Growth and Development NE-4103

Problem 1 Measure physiological performance of trees following stress and evaluate mechanisms leading to health declines

FY1999 Research Attainment

Publications

Cooperative

DeHayes, D.H.; Schaberg, P.G.; Hawley, G.J.; Strimbeck, G.R. 1999. Acid rain impacts on calcium nutrition and forest health. BioScience. 49(10): 789-800.

Hadley, J.L.; Schaberg, P.G. 1999. Winter photosynthesis in conifers and its environmental controls. In: Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America. 84:19. Abstract.

Attainment

We have defined and verified the physiological mechanism whereby acid deposition disrupts the calcium nutrition and cold tolerance of red spruce (3 manuscripts in press), and are assessing if this same mechanism is applicable to other species. Separate work has determined that, despite its vulnerability to freezing injury, red spruce can be physiologically active and add to foliar sugar stores during winter (1 manuscript submitted). Work has also begun to examine the physiology of fall foliage color development in sugar maple. A better understanding of this process could improve our ability to predict and perhaps even influence fall foliage color, a phenomenon of great public interest and direct financial importance to tourism throughout New England. Other work is examining how tree carbon reserves influence the response of maples to stress. For example, two studies were established to determine the effect of the massive January 1998 ice storm on carbohydrate reserves and tree health. We are also assessing how crown dieback influences winter carbon storage, tree growth, and survival.

4103 The Role of Environmental Stress on Tree Growth and Development NE-4103

Problem 2 Towards a better understanding of water-stress physiology: hydraulic sufficiency of stems to conduct water to leaves

FY1999 Research Attainment

Publications

Research Unit

Tyree, M.T.; Sobrado, M.A.; Stratton, L.J.; Becker, P. 1999. Diversity of hydraulic conductance in leaves of temperate and tropical species: possible causes and consequences. Journal of Tropical Forest Science. 11(1): 47-60.

Tyree, Melvin T. 1999. Water relations and hydraulic architecture. In: Pugnaire, Francisco I.; Valladares, Ferando, comps., eds. Handbook of functional plant ecology. New York, New York: Marcel Dekker, Inc.: 222-268.

Tyree, Melvin T. 1999. Water relations of plants. In: Baird, Andrew J.; Wilby, Robert L., comps., eds. Eco-Hydrology. New York, New York: Routledge: 11-38.

Tyree, Melvin, Thomas; Salleo, Sebastrano; Nardini, Andrea; Lo Gullo, Maria Assunta; Mosca, Roberto. 1999. Refilling of embolized vessels in young stems of laurel. Do we need a new paradigm? Plant Physiology. 120(1): 11-21.

Cooperative

Becker, Peter; Tyree, Melvin T.; Tsuda, Makoto. 1999. Hydraulic conductances of angiosperms versus conifers: similar transport sufficiency at the whole-plant level. Tree Physiology. 19: 445-452.

Lo Gullo, Maria A.; Nardini, Andrea; Salleo, Sebastiano; Tyree, Melvin T. 1998. Changes in root hydraulic conductance (KR) of Olea oleaster seedlings following drought stress and irrigation. New Phytologst. 140: 25-31.

Nardini, Andrea; Tyree, Melvin T. 1999. Root and shoot hydraulic conductance of seven Quercus species. Annals of Forestry Science. 56: 371-377.

Wei, Chunfang; Steudle, Ernst; Tyree, Melvin T. 1999. Water ascent in plants: do ongoing controversies have a sound basis? Trends in Plant Science. 4(9): 372-375.

Attainment

The NSF project on Psychotria species in the neotropics (Panama), which started in May 1997 is in its final year. The Forest Service contribution to the program concerns the water relations of Psychotria species and computer model development. We are currently writing 4 manuscripts detailing the water relations of 9 species of this genus. We have also spent 3 months writing a Windows 98 program that models for the light interception, photosynthesis, hydraulic architecture and growth of the species. The purpose of the model is to gain a better understanding of the physiological adaptations of each species for their environment. The research project on the Cohesion-Tension Theory (conducted in Bayreuth and Wuerzburg, Germany, funded by the Humboldt Foundation) is now complete. Three manuscripts have been written; one is published, one is in press, and one is still under review. The research also contributed to the PhD of a University of Vermont cooperator, Dr. C. Wei. This type of research will now continue in Vermont since we have replicated the equipment from Germany. Our results so far are in complete agreement with the Cohesion-Tension Theory.

4104 Measurement, Analysis, and Modeling of Forest Ecosystems in a Changing Environment
Solomon, Dale S, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Mechanistic analyses need to be advanced to reduce uncertainty about the consequences of ecosystem management alternatives and to assess the consequences of a changing environment	183	1.5	0	0	0
2. Techniques to scale up biophysical processes from the levels of organs and organisms to ecosystems and landscapes need to be developed	183	1	1	1	0
3. Knowledge of underlying processes must be integrated into operational tools to provide quantitative methods for adaptively managing our forest ecosystems	184	1.5	1	0	0

4104 Measurement, Analysis, and Modeling of Forest Ecosystems in a Changing Environment NE-4104

Problem 1 Mechanistic analyses need to be advanced to reduce uncertainty about the consequences of ecosystem management alternatives and to assess the consequences of a changing environment

FY1999 Research Attainment

Publications

Attainment

Progress was concentrated in three areas: (1) Work neared completion of the initial version AMORPHYS, a metabolically based model of forest growth that affords assessment of the effects of management and environmental changes; (2) using interim results from the Free Air Carbon Enrichment or FACE study at DUKE, analyses were conducted with PIPESTEM to estimate the effects of increasing atmospheric carbon dioxide on the growth of loblolly pine plantations in the next 20 to 50 years. A significant increase in yield (over 6 percent) is expected in 25 years. The dividend is larger for longer rotations; (3) Bayesian synthesis methods were advanced to bound projection errors of process-based models of forest growth and development. The method incorporates information internal to the model and all available external information. The method is expected to be generally applicable to mechanistic or process-based models.

4104 Measurement, Analysis, and Modeling of Forest Ecosystems in a Changing Environment NE-4104

Problem 2 Techniques to scale up biophysical processes from the levels of organs and organisms to ecosystems and landscapes need to be developed

FY1999 Research Attainment

Publications

Extramural

McFadden, Joseph, P.; Chapin, F. Stuart III; Hollinger, David Y.1998. Subgrid-scale variability in the surface energy balance of arctic tundra. Journal of Geophysical Research. 103(D22): 28,947-28,961.

Attainment

A long-term study of ecosystem carbon and water exchange is continuing in a spruce-hemlock forest in northern Maine with cooperators from the University of Maine and the Woods Hole Research Center. The forest is part of the AmeriFlux network of eddy covariance research sites investigating forest carbon uptake. Recent results suggest that this forest continues to store about 2 tons of carbon per hectare per year. Atmospheric profiles of CO2 concentration were carried out via light aircraft to extend the results from the forest for application on a regional basis. New studies examining spatial variability in forest CO2 fluxes were initiated.

4104 Measurement, Analysis, and Modeling of Forest Ecosystems in a Changing Environment NE-4104

Problem 3 Knowledge of underlying processes must be integrated into operational tools to provide quantitative methods for adaptively managing our forest ecosystems

FY1999 Research Attainment

Publications

Research Unit Solomon, Dale S.; Gove, Jeffrey H. 1999. Effects of uneven-age management intensity on structural diversity in two major forest types in New England. Forest Ecology and Management. 113: 265-274.

Attainment Basal area is a key variable in forest management. In the work accomplished, it has been shown how to arrive at a formal parameterization of the probable distribution of diameters based on basal area. Such parameterization is useful in linking traditional diameter distributions with distributions that arise from probability proportional to size sampling methods. A model has been finalized which is useful in assessing the tradeoffs between components of ecosystem management in spruce-fir stands. Specifically, the model of optimal uneven-aged management determines the stand diameter distribution that maximizes an economic objective while preserving bird species and stand structural diversity.

The application of the project developed forest growth model FIBER has provided the yield information for a forest sustainability study for the State of Maine. Utilizing the ecological based growth components of the model, FIA plots were projected by forest habitat conditions to produce yield for the ATLAS model for development of a sustainaibility policy for the State of Maine. Presently, FIBER is being used on FIA plots across the northern New England States of NH, VT and NY to project yield for a similar sustainable forestry study.

4152 Understanding and Managing Forest Ecosystems of the Allegheny Plateau Region
Stout, Susan L, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Regeneration and forest renewal	266	1	2	1	0
2. Stand dynamics and silviculture	417	.5	3	3	0
3. Sugar maple decline	309	1	0	3	4

4152 Understanding and Managing Forest Ecosystems of the Allegheny Plateau Region NE-4152

Problem 1 Regeneration and forest renewal

FY1999 Research Attainment

Publications

Research Unit

deCalesta, David S. 1999. Effects of deer on forest resources: ecosystem, landscape, and management perspectives. In: The Wildlife Society 5th annual conference: excellent in wildlife stewardship through science and education; 1998 SEPTEMBER 22-26; Buffalo, NY. Bethesda, MD: The Wildlife Society: 76-77. Abstract.

Ristau, Todd E.; Horsley, Stephen B. 1999. Pin cherry effects on Allegheny hardwood stand development. Canadian Journal of Forest Research. 29: 73-84.

Extramural

Lawrence, Richard K.; Stout, Susan L.; deCalesta, David S.; Porter, William F.; Underwood, H. Brian. 1999. Forest regeneration: can we overwhelm deer? In: The Wildlife Society 5th annual conference: excellence in wildlife stewardship through science and education; 1998 SEPTEMBER 22-26; Buffalo, NY. Bethesda, MD: The Wildlife Society: 104-105. Abstract.

Attainment

Scientists used results from several long-term studies, including one that has run for more than 50 years, to analyze the effects of different densities of pin cherry (Prunus pennsylvanica) on stand development from stand initiation through understory reinitiation. When there are more than 2 pin cherry stems taller than 5 feet tall on a six-foot radius sample plot at age three, black cherry seedlings, as well as those of red and sugar maple, are unlikely to persist at that location through age 15. Black cherry stump sprouts are able to compete successfully with pin cherry. Continuous measurements from a study installed in a 13-year-old stand in 1936 show that cubic volume production through age 70 in stands from which dense pin cherry saplings were removed as part of a weeding study was about twice that of stands that did not have dense pin cherry removed.

In other work, scientists continue to study the relationships between landscape food supply and local deer density as they influence the composition and diversity of the forest understory. When forest cutting, interspersions of agriculture or development with forests, or other openings provide high levels of deer forage, understory diversity and regeneration success improve. But controlling deer density directly appears to be more effective as a tool for controlling deer impact.

4152 Understanding and Managing Forest Ecosystems of the Allegheny Plateau Region NE-4152

Problem 2 Stand dynamics and silviculture

FY1999 Research Attainment

Publications

Research Unit

deCalesta, D.S.; Ordiway, L.D. 1999. Classification and regression trees (CART) for modeling wildlife habitat relationships. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 85. Abstract.

deCalesta, D.S.; Ordiway, L.D. 1999. Contribution of RNA's to forest wildlife management. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 86. Abstract.

Ordiway, Linda D.; deCalesta, David S. 1999. Do point counts of singing male songbirds reflect demography? In: The Wildlife Society 5th annual conference: excellence in wildlife stewardship through science and education; 1998 SEPTEMBER 22-26; Buffalo, NY. Bethesda, MD: The Wildlife Society: 121-122. Abstract.

Cooperative

Long, R.; Horsley, S.; Stout, S.; Lilja, P.; Hall, T. 1999. Long-term research on forest nutrition and health in north central Pennsylvania. In: 84th annual meeting: legacies, landscapes and limits: bridging borders: Ecological Society of America; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 275. Abstract.

Extramural

Nowak, C.A.; Stout, S.L. 1999. The 30/30/30 rules for black cherry and Allegheny hardwood forests. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 157. Abstract.

Palmer, John; Dunshie, Dale; Stout, Susan. Federal forest practices and their applications to public and private lands. Pennsylvania forests. 90(2): 8-10.

Pauley, Thomas K.; Mitchell, Byron J. 1999. Potential effects of silvicultural practices and deer densities on forest salamanders in northwestern Pennsylvania. ASB Bulletin. 46(2): 139. Abstract.

Attainment

Scientists are using data collected from a series of studies to quantify the effects of forest stand development and silviculture on several key wildlife communities. Wildlife demographic data have been collected for small mammals, amphibians, and songbirds in more than 40 Allegheny hardwood stands of northwestern Pennsylvania, representing all stages of stand development from stand initiation through true old growth. Preliminary analyses suggest that habitat characterization can be used to classify stands by habitat quality with better than 75% accuracy for most bird species.

This year, these data were used to show that the effects of an outbreak of elm spanworm on bird demographics were reflected in data collected through traditional point count methods. Bird communities were sampled in twenty stands prior to the outbreak. At the height of the outbreak, when the abundance of insects provided a large food base for bird populations, abundance in most sampled species increased. In another study, abundance of red-backed salamanders was measured at a single, summer, sampling data in study plots that had been treated with different silvicultural treatments ten years earlier and maintained at different deer densities for the intervening decade. Salamander abundance differed by silvicultural treatment--there were fewer in young clearcuts--but not by deer density. No treatment eliminated the species.

4152 Understanding and Managing Forest Ecosystems of the Allegheny Plateau Region NE-4152

Problem 3 Sugar maple decline

FY1999 Research Attainment

Publications

Cooperative

Bailey, Scott; Horsley, Stephen B.; Long, Robert P.; Hallett, Richard A. 1999. Influence of geologic and pedologic factors on health of sugar maple on the Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 63-65.

Hallett, R.A.; Bailey, S.W.; Horsley, S.B.; Long, R.P.; Hall, T.J. 1999. Foliar chemistry and sugar maple health in the northeastern United States. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 113. Abstract.

Hallett, Richard A.; Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hall, Thomas J. 1999. Foliar chemistry of sugar maple: a regional view. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 66. Abstract.

Horsley, S.; Long, R.; Bailey, S.; Hallett, R.; Hall, T. 1999. Factors contributing to decline-disease of sugar maple in Pennsylvania. In: 84th annual meeting: legacies, landscapes and limits: bridging borders: Ecological Society of America; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 112. Abstract.

Horsley, Stephen B.; Long, Robert P., eds. 1999. Sugar maple ecology and health, proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 120 p.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A. 1999. Factors contributing to the decline-disease of sugar maple on Pennsylvania's Allegheny Plateau. The Dropline. 2(4): 1.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A.; Hall, Thomas J. 1999. Factors contributing to sugar maple decline along topographic gradients on the glaciated and unglaciated Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen.Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 60-62.

Long, Robert P.; Horsley, Stephen B.; Lilja, Paul R. 1999. Impact of forest liming on growth, vigor, and regeneration of sugar maple and associated hardwoods. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol. 1. The effects of acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Insititute: 263-264. Abstract.

Long, Robert P.; Horsley, Stephen B.; Lilja, Paul R. 1999. Impact of forest liming on growth, vigor, and reproduction of sugar maple and associated hardwoods. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 55-58.

4152 Understanding and Managing Forest Ecosystems of the Allegheny Plateau Region NE-4152

Problem 3 Sugar maple decline

FY1999 Research Attainment

Publications

Extramural

Drohan, Patrick J.; Petersen, Gary W.; Stout, Susan L. 1999. An assessment of sugar maple decline on the Appalachian Plateau, Ecoregions 212F and 212G. In: Sharpe, William, E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol. 1. The effects of acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University Environmental Resources Research Center: 265-166. Abstract.

Drohan, Patrick; Stout, Susan.; Petersen, Gary. Spatial relationships between sugar maple (Acer saccharum Marsh, sugar maple decline, slope, aspect, and atmospheric deposition in northern Pennsylvania. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. Ne-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 46-50.

Swistock, Bryan R.; DeWalle, David R.; Horsley, Stephen B.; Long, Robert P.; Hall, Thomas J.; Bailey, Scott. 1999. Soil water chemistry in declining and non-declining sugar maple stands. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol 1. The effects of acid deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 63-72.

Attainment

The proceedings of the 1998 International Symposium on Sugar Maple Ecology and Health were published this year. This publication contains the most current insights from Canadian and US scholars who have studied sugar maple decline events from Wisconsin to Quebec, from the 1950s to the present. The publication shows that most studies implicated deficiencies of nutrition, especially nutrition associated with base cations, as predisposing conditions. In most declines, a further inciting event, such as a series of droughts or insect defoliations, also occurred. Scientists studying the current sugar maple decline in northern Pennsylvania showed that unhealthy stands (those with more than 20% dead sugar maple basal area) were distinguished from healthy stands because they had foliar magnesium levels below 700 parts per million and had been defoliated moderately or severely at least twice in the preceding decade. Other work conducted by Forest Service scientists and their colleagues showed that the decline was detectable in the data from the 1989 Forest Inventory and Analysis assessment of Pennsylvania and that about 10% of the stands sampled across the northern tier of Pennsylvania showed symptoms of decline. Bedrock geology appeared to be key to foliar nutrition levels in sampled stands, and forest liming was successful in stimulating improved growth, vigor, seed production, and survival in overstory sugar maple trees, but did not affect these variables in black cherry or American beech.

4153 Quantitative Methods for Modeling and Monitoring Response of NE Forest Ecosystems to Management and Environmental Stresses
Yaussy, Daniel, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Managers need improved methods for predicting natural communities and their response to management and disturbance	338	2.8	7	8	0
2.	Ecosystem management practices must be developed to meet demand for sustainabilty while providing timber products	323	1.3	4	2	0
3.	Integrated methods of monitoring forest ecosystems are needed for sustainability and scientific understanding	169	1	1	2	0

4153 Quantitative Methods for Modeling and Monitoring Response of NE ForestEcosystems to Management and Environmental Stresses NE-4153

Problem 1 Managers need improved methods for predicting natural communities and their response to management and disturbance

FY1999 Research Attainment

Publications

Research Unit

Iverson, L.R.; Prasad, A.M. 1999. Identifying potential future tree species distributions and forest types in the eastern U.S. In: 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 127. Abstract.

Iverson, Louis R.; Prasad, Anantha M. 1998. Predicting abundance of 80 tree species following climate change in the eastern United States. Ecological Monographs. 68(4): 465-485.

Iverson, Louis R.; Prasad, Anantha M.; Schwartz, M. 1999. Possible future tree distributions and forest types in the eastern U.S. In: Landscape ecology: the science and the action: 5th World Congress, International Association for Landscape Ecology; 1999 JULY 29-AUGUST 3; Snowmass Village, CO; [Place of publication unknown]: [Publisher name unknown]: 74. Abstract.

Iverson, Louis R.; Prasad, Anantha; Schwartz, Mark W. 1999. Modeling potential future individual tree-species distributions in the eastern United States under a climate change scenario: a case study with Pinus virginiana. Ecological Modeling. 115: 77-93.

Scherzer, A.J.; Rebbeck, J.; Long, R.P. 1999. Effects of prescribed fire on foliar nutrients of oak, hickory, and red maple in a southern Ohio forest. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 187. Abstract.

Yaussy, Dan. 1999. Prescribed burning to restore oak ecosystems in Ohio. The Ohio Hetuch. 23(3): 11-12.

Yaussy, Daniel A. 1999. Comparison of NE-TWIGS and ZELIG on actual growth of two sites in Kentucky. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: US. Department of Agriculture, Forest Service, Southern Research Station: 285. Abstract.

Yaussy, Daniel; Iverson, Louis; Prasad, Anantha. 1999. Diameter-growth model across shortleaf pine range using regression tree analysis. In: Amaro, Ana; Tome, margarida, eds. Empirical and process-based models for forest tree and stand growth simulation; 1997 SEPTEMBER 21-27; Oeiras, Portugal. Oeiras, Portugal: Salamandra: 479-495.

4153 Quantitative Methods for Modeling and Monitoring Response of NE ForestEcosystems to Management and Environmental Stresses NE-4153

Problem 1 Managers need improved methods for predicting natural communities and their response to management and disturbance

FY1999 Research Attainment

Publications

Extramural

Artman, Vanessa L.; Downhower, Jerry F. 1999. Nest site selection of forest birds in relation to prescribed burning: a multivariate analysis. In: Program for the 117th stated meeting of the American Ornithologists Union; 1999 AUGUST 10-14; Ithaca, NY. [Place of publication unknown]: [Publisher name unknown]. Abstract.

Boerner, R.E.J.; Brinkman, J.A. 1999. Effects of fire on soil N and N mineralization at two spatial scales in mixed oak forests. In: Soil Ecology Society international conference: out of the black box: ecological lessons from the underground; 1999 MAY 23-26; Chicago, IL. [Place of publication unknown]: [Publisher name unknown]. Abstract.

Boerner, R.E.J.; Sutherland, E.K. 1999. Impacts of prescribed fire at two frequencies on belowground processes and functional diversity in Ohio oak-hickory forests. In: Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 8-9. Abstract.

Brinkman, J.A.; Boerner, R.E. 1999. Effects of fire on soil N and N mineralization in two spatial scales in at mixed oak forests. In: Ecological Society of America 84th annual meeting; legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 232. Abstract.

Decker, Kelly L.M.; Boerner, Ralph E.J.; Morris, Sherri Jeakins. 1999. Scale-dependent patterns of soil enzyme activity in a forested landscape. Canadian Journal of Forest Research. 29: 232-241.

Dress, W.J.; Knorr, M.A.; Boerner, R.E.J. 1999. Fine root biomass and production following prescribed burning in an oak-hickory forest in southern Ohio. In: Soil Ecology Society international conference: out of the black box: ecological lessons from the underground; 1999 MAY 23-26; Chicago, IL. [Place of publication unknown]: [Publisher name unknown]. Abstract.

Dress, W.J.; Knorr, M.A.; Boerner, R.E.J. 1999. Fine-root biomass and production following prescribed burning in an oak-hickory forest in southern Ohio. In: Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 246. Abstract.

Endress, Gregory A.; Endress, Anton G. 1999. Drought and ozone stress effects on competition among selected prairie grass species and giant foxtail. HortTechnology. 9(2): 227-234.

4153 Quantitative Methods for Modeling and Monitoring Response of NE ForestEcosystems to Management and Environmental Stresses NE-4153

Problem 1 Managers need improved methods for predicting natural communities and their response to management and disturbance

FY1999 Research Attainment

Publications

Attainment

FY99 publications on the potential range shifts of 80 tree species of the Eastern United States under global climate change, led to invitations to serve on two National Assessment panels with a large workload to determine potential range shifts under five different GCM scenarios. We are serving on the forestry component of the Mid Atlantic Regional Assessment (MARA), as well as the biodiversity component of the Forestry Sector of the National Assessment team. Besides assessments and analysis summaries for the report to Congress, we also are preparing peer reviewed publications for both teams.

A new web site has been established (www.fs.fed.us/ne/delaware/atlas) which provides a vast amount of information on the forest resources of the eastern United States. It provides data on current and potential future distributions of 80 important tree species of the Eastern United States in the face of global climate change (displayed for five different GCM scenarios). It also provides a detailed database on species attributes, especially related to regeneration, and GIS-derived environmental factors associated with the distribution of the species. Efforts to project the development of regional forests under global change scenarios, require the use of a suitable growth and development simulator. A mechanstic successional simulator that includes climate as a driving variable was compared to an empirical growth and yield simulator on actual growth of stands in Kentucky. The mechanistic model provided very poor estimates of growth and the empirical model proved adequate. However, the empirical model does not take advantage of climate information in its predictions. In order to improve the predictions of the mechanistic model, methods to improve estimation of diameter growth were investigated using regression tree analysis. This method provided better estimates than the method used in the mechanistic model, especially at the edges of the species range.

4153 Quantitative Methods for Modeling and Monitoring Response of NE ForestEcosystems to Management and Environmental Stresses NE-4153

Problem 2 Ecosystem management practices must be developed to meet demand for sustainabilty while providing timber products

FY1999 Research Attainment

Publications

Research Unit

Hutchinson, T.F.; Sutherland, S.; Iverson, L.R.; Sutherland, E.K. 1999. Response of understory vegetation to prescribed fire in Ohio oak-hickory forests. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millenim: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 125. Abstract.

Iverson, Louis R.; Prasad, Anantha. 1998. Estimating regional plant biodiversity with GIS modeling. Diversity and Distributions. 4(2): 49-61.

Sutherland, E.K. 1999. From savannah to forest: restoration approaches and challenges in oak forests of the Midwest. In: Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 36. Abstract.

Yaussy, D.A.; Smith, W.; Lashbrook, W. 1999. Raccoon Ecological Management Area: partnership between Forest Service Research and MEAD Corporation. In: Long-term silvicultural research sites workshop. Promoting the concept--protecting the investment; 1998 OCTOBER 25-28; Victoria, BC. [Place of publication unknown]: Canadian Forest Service: 85. Abstract.

Extramural

Lashbrook, Wayne. 1999. Non-industrial private forest demonstration plots - MEAD Vinton Furnace Experimental Forest. The Ohio Hetuch. 23(3): 22-23.

Morris, Sherri Jeakins; Boerner, R.E.J. 1998. Interactive influences of silvicultural management and soil chemistry upon soil microbial abundance and nitrogen mineralization. Forest Ecology and Management. 103: 129-139.

Attainment

This year the study on the use of prescribed burning to restore oak ecosystems has revealed the following:
· These surface fires do not increase the soil temperature at 1 cm, below ground, to above 85 degrees (F).
· Soil temperatures at burned sites may increase more than 40 degrees (F) above unburned sites due to increased solar radiation, prior to leaf-out.
· Fire increases nitrogen mineralization in the soil.
· Fire improves retention of fine roots
· Foliar nutrients of trees was unaffected by fire; however, nitrogen content increased in the foliage of blueberry plants in the burned areas.
· Fire has increased the abundance of some rare plants and increased plant biodiversity.
· Biodiversity of nesting birds and arthropods, did not change due to fire.
· Burning did not decrease the number of oak seedlings and sprouts but did decrease the number of maples.

Classical survival analysis of thirty years of tree measurement data have shown that drought, soil nitrogen, rate of growth and species of tree are predictors of tree mortality in the oak-hickory forest. Mortality rates differed by tree species with an average sized scarlet oak (Quercus coccinea) being 20 percent more likely to die than an average tree, while a red maple (Acer rubrum) is close to 200% less likely to die.

4153 Quantitative Methods for Modeling and Monitoring Response of NE ForestEcosystems to Management and Environmental Stresses NE-4153

Problem 3 Integrated methods of monitoring forest ecosystems are needed for sustainability and scientific understanding

FY1999 Research Attainment

Publications

Research Unit

Scott, Charles T.; Kohl, Michael; Schnellbacher, Hans Jorg. 1999. A comparison of periodic and annual forest surveys. Forest Science. 45(3): 433-451.

Smith, K.T.; Sutherland, E.K. 1999. Fire scar structure in oak. In: Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 308. Poster.

Smith, Kevin T.; Sutherland, Elaine Kennedy.1999. Fire-scar formation and compartmentalization in oak. Canadian Journal of Forest Research. 29(2): 166-171.

Extramural

Morris, Sherri Jeakins. 1999. Spatial distribution of fungal and bacterial biomass in southern Ohio hardwood forest soils: fine scale variability and microscale patterns. Soil Biology and Biochemistry. 31: 1375-1386.

Morris, Sherri Jeakins; Boerner, R.E.J. 1999. Spatial distribution of fungal and bacterial biomass in southern Ohio hardwood forest soils: scale dependency and landscape patterns. Soil Biology and Biochemistry. 31: 887-902.

Attainment

Little is known of the historic fire regime in the oak-hickory forests. Efforts to reconstruct this history using dendrochronology would be aided by a detailed characterization of the morphology of fire scars resulting in hardwoods which experience low-intensity surface fires. Trees were destructively sampled from an area in which two prescribed burns had been conducted. Scars resulting from these fires were characterized as a sample to aid others in determining scars resulting from past, undocumented fires.

Interest is strong in moving from periodic surveys to annual forest surveys. Several countries in Europe have switched to a system of measuring a portion of their plots each year. An evaluation of the factors involved in this switch was conducted for the Swiss National Forest Inventory. This list of evaluation factors was applied to a set of design options (for a total of 52 possible survey designs). Four annual survey designs emerged as candidates for further study. Each of three estimation methods were applied to four sampling designs for conducting surveys on an annual basis. The data used in this comparison were collected on 682 plots over seven successive years across Switzerland. The three estimation methods, which were applied to each design, had increasing levels of precision and complexity: Continuous Forest Inventory, Sampling with Partial Replacement, and Mixed Estimation.

These used simple means, regression updating and inverse weighting of new and old plots, and regression combined with growth model projections, respectively. For the 12 attributes evaluated, the Sampling with Partial Replacement estimation method was the most efficient. The Permanent Regional Survey design was the most cost-effective, followed by the Permanent National or Regional Surveys with a Periodic Update designs. The Periodic National Survey (existing design) by the Permanent National Survey (similar to the US Forest Service Inventory and Analysis design) were the least cost-effective.

4155 Ecology and Management of Northern Forest Ecosystems
Brissette, John C, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Understanding both ecologic and economic impacts of forest ecosystem manipulation	450	2.5	10	1	1
2. Understanding relationships between compostion and strucure of forests and the needs of wildlife	388	1.4	5	1	0
3. Understanding how natural and anthropogenic disturbances affect ecological processes	372	2.1	4	0	2

4155 Ecology and Management of Northern Forest Ecosystems NE-4155

Problem 1 Understanding both ecologic and economic impacts of forest ecosystem manipulation

FY1999 Research Attainment

Publications

Research Unit

Brissette, John C. 1999. An American forester in Siberia. 79th winter meeting New England Society of American Foresters; 1999 MARCH 23-25; Burlington, VT. [Place of publication unknown]: [Publisher name unknown]. Poster.

Dibble, Alison C.; Brissette, John C.; Hunter, Malcolm 1., Jr. 1999. Putting community data to work: some understory plants indicate red spruce regeneration habitat. Forest Ecology and Management. 113: 275-291.

Kenefic, L.S.; Brissete, J.C.; Seymour, R.S. 1999. Dynamics of overstory species composition in managed uneven-aged northern conifer stands. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 135. Abstract.

Kenefic, L.S.; Seymour, R.S. 1999. New perspectives on uneven-aged silviculture in northern conifers: growing space distribution as a means for evaluating traditional approaches to structural control. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 136. Abstract.

Kenefic, Laura S.; Nyland, Ralph D. 1999. Sugar maple height-diameter and age-diameter relationships in an uneven-aged northern hardwood stand. Northern Journal of Applied Forestry. 16(1): 43-47.

Leak, William B. 1999. Stand structure in evenaged northern hardwoods: development and silvicultural implications. Northern Journal of Applied Forestry. 16(2): 115-119.

Leak, William B.; Lamson, Neil I. 1999. Revised white pine stocking guide for managed stands. NA-TP-01-99. Radnor, PA: U.S.Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry: 2.

Maguire, Douglas A.; Brissette, John C.; Gu, Lianhong. 1998. Crown structure and growth efficiency of red spruce in uneven-aged, mixed-species stands in Maine. Canadian Journal of Forest Research. 28: 1233-1240.

Sendak, Paul E.; Leak, William B. 1999. Tree-quality development in northern hardwoods. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of the Canadian and northeastern forest economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service - Atlantic Forestry Centre: 212-219.

Wagner, R.G.; Fraver, S.R.; Seymour, R.S.; Day, M.E.; White, A.S.; Greenwood, M.S.; Hunter, M.L.; Hartley, M.J.; Fernandez, I.J.; Brissette, J.C. 1999. Ecological effects of expanding-gap silvicultural systems in the Acadian Forest. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: foresty ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 213. Abstract.

Cooperative

Brissette, J.C.; Ducey, M.J.; Gove, J.H. 1999. A field test of point relaskop sampling of coarse woody material in managed stands in the Acadian forest. Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 73. Abstract.

Dennis, Donald F.; Sendak, Paul E.; McEvoy, Thomas J. 1999. Stumpage prices in Vermont and New Hampshire. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of the Canadian and Northeastern Economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service; Atlantic Forestry Centre: 246-248.

Extramural

Wilson, Duncan S.; Seymour, Robert S.; Maguire, Douglas A. 1999. Density management diagram for northeastern red spruce and balsam fir forests. Northern Journal of Applied Forestry. 16(1): 48-56.

4155 Ecology and Management of Northern Forest Ecosystems NE-4155

Problem 1 Understanding both ecologic and economic impacts of forest ecosystem manipulation

FY1999 Research Attainment

Publications

Attainment

Much of the work under Problem 1 continues to focus on long-term research into questions about the ecology and management of northern forest ecosystems, including the economic aspects of forest management. At the Bartlett Experimental Forest in the White Mountains of New Hampshire, the emphasis is on northern hardwoods. At the Penobscot Experimental Forest in east-central Maine, mixed northern conifers are the focus. A new long-term study is about 60 percent established on the Bartlett Experimental Forest. This size-of-opening study will provide managers with answers to questions about forest response to a range of regeneration methods from single tree selection to clearcutting. This study also provides a basis to measure wildlife response to habitat changes (see Problem 2). Data from both Bartlett and Penobscot continue to be used to refine and improve regional growth and yield models. Both Bartlett and Penobscot Experimental Forests continue to be centers for technology transfer efforts to professionals, students, and the public. Research on these forests is well known and they attract visitors locally, nationally, and internationally. The RWU received a Chief's Natural Resources Agenda grant for technology transfer efforts on the Massabesic Experimental Forest in densely populated southern Maine. Technology transfer at Massabesic is in partnership with a number of state and local groups and focuses on public awareness and education. An ecological inventory of the Massabesic is approximately 80 percent completed. The inventory will provide unit scientists and cooperators with information needed to plan ecology and management research in eastern white pine and northern red oak forest types.

4155 Ecology and Management of Northern Forest Ecosystems NE-4155

Problem 2 Understanding relationships between compostion and strucure of forests and the needs of wildlife

FY1999 Research Attainment

Publications

Research Unit

Costello, Christine A.; Yamasaki, Mariko; Medeiros, Michael. 1999. Five years of breeding bird data from group selection and clearcut stands in the White Mountain National Forest, New Hampshire. 55th annual northeast fish and wildlife conference; 1999 APRIL 11-14; Manchester, NH. [Place of publication unknown]: [Publisher name unknown]: 41. Poster.

Yamasaki, M. 1999. Dead and down woody debris on the Bartlett Experimental Forest. Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30.; Orono, ME. Orono, ME: University of Maine: 227. Abstract.

Yamasaki, Mariko. 1999. Dead and down woody debris on the Barlett Experimental Forest. 55th annual northeast fish and wildlife conference; 1999 APRIL 11-14; Manchester, NH. [Place of publication unknown]: [Publisher name unknown]: 15-16. Abstract.

Yamasaki, Mariko. 1999. Marine turtles of the Gulf of Maine. In: Hunter, Malcolm L., Jr.; Calhoun, Aram J.K.; McCollough, Mark, comps., eds. Maine Amphibians and Reptiles. Orono, ME: The University of Maine Press: 152-158.

Yamasaki, Mariko; Medeiros, Michael George; Costello, Christine A. 1999. Preliminary data on nesting habitat of northern goshawks on the White Mountain National Forest and adjacent lands. 55th annual northeast fish and wildlife conference; 1999 APRIL 11-14; Manchester, NH. [Place of publication unknown]: [Publisher name unknown]: 45. Poster.

Extramural

Sweeney, James Patrick Thomas. Winter habitat selection by bald eagles in New Hampshire. University of New Hampshire: M.S. Thesis. 37.

Attainmen.

Progress continues in describing associations between forest dwelling wildlife and forest structure. Cooperative work with the University of New Hampshire on stream salamander and fish competition in various watersheds in the White Mountains of New Hampshire continues. Sampling continues on breeding bird and small mammals on the size-of-opening study (see Problem 1) on the Bartlett Experimental Forest. In cooperation with University of New Hampshire researchers, progress continues on describing the effects of the January 1998 ice storm disturbance and forest management practices on terrestrial salamander habitat and occurrence in the size-of-opening study. Mist net and ultrasonic detection sampling for forest bats was initiated on the size-of-opening study on the Bartlett Experimental Forest in response to the need by National Forest specialists for information on bat use of forest habitats in the White Mountains of New Hampshire.

4155 Ecology and Management of Northern Forest Ecosystems NE-4155

Problem 3 Understanding how natural and anthropogenic disturbances affect ecological processes

FY1999 Research Attainment

Publications

Research Unit

Hallett, R.A.; Bowden, W.B.; Smith, C.T. 1999. Nitrogen dynamics in forest soils after municipal sludge additions. Water, Air, and Soil Pollution. 112: 259-278.

Hallett, Richard A. 1999. Forest soils research, transcending disciplines and scales. In: Proceedings of the Northeast cooperative soil survey conference; 1998 JUNE 20-23; Bangor, ME. Bangor, ME: Northeast Cooperative Soil Survey.

Hallett, Richard A.; Martin, Mary E. 1999. Mapping foliar cation chemistry using remote sensing. 63rd annual meeting Northeast Section of American Society of Plant Physiologists; 1999 APRIL 23-24; Durham, NH. Durham, NH: University of New Hampshire. Abstract 0-07.

Livingston, W.H.; Greenwood, M.S.; Day, M.E.; White, A.S.; Brissette, J.C. 1999. Factors influencing growth and survival of jack pine (Pinus banksiana) and pitch pine (P. rigida) in overlapping ecological niches at their respective range limits. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 144. Abstract.

Cooperative

Bailey, Scott; Horsley, Stephen B.; Long, Robert P.; Hallett, Richard A. 1999. Influence of geologic and pedologic factors on health of sugar maple on the Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 63-65.

Hallett, R.A.; Bailey, S.W.; Horsley, S.B.; Long, R.P.; Hall, T.J. 1999. Foliar chemistry and sugar maple health in the northeastern United States. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 113. Abstract.

Hallett, Richard A.; Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hall, Thomas J. 1999. Foliar chemistry of sugar maple: a regional view. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 66. Abstract.

Hislop, J.E.; Hornbeck, J.W.; Bailey, S.W.; Hallett, R.A.1998. Development of internal forest soil reference samples and testing of digestion methods. Communications in Soil Science and Plant Analysis. 29(11-14): 1991-1996.

Horsley, S.; Long, R.; Bailey, S.; Hallett, R.; Hall, T. 1999. Factors contributing to decline-disease of sugar maple in Pennsylvania. In: 84th annual meeting: legacies, landscapes and limits: bridging borders: Ecological Society of America; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 112. Abstract.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A. 1999. Factors contributing to the decline-disease of sugar maple on Pennsylvania's Allegheny Plateau. The Dropline. 2(4): 1.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A.; Hall, Thomas J. 1999. Factors contributing to sugar maple decline along topographic gradients on the glaciated and unglaciated Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen.Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 60-62.

4155 Ecology and Management of Northern Forest Ecosystems NE-4155

Problem 3 Understanding how natural and anthropogenic disturbances affect ecological processes

FY1999 Research Attainment

Publications

Attainment

Majority of the work under this problem is progressing under the cooperative project MAPBGC (Mapping and Analysis of Forest Productivity and Biogeochemical Cycling) for the White Mountain Region of New Hampshire. Papers will be published on preliminary and intensive work at the Bartlett Experimental Forest, which focuses on historical land-use effects of forest productivity and response to climate change by combining hyperspectral remote sensing, field data and modeling analysis. Current efforts focus on applying developed relationships to the wider White Mountain National Forest landscape. Other work includes the regional sugar maple study that examines relationships among sugar maple health, growth and site characteristics in order to understand sugar maple decline disease. Samples are being collected from a network of 80 sites stretching from northern New Hampshire to northwestern Pennsylvania.

4251 Wildlife and Fish Habitat Relationships and Recreation Opportunities In New England Forests
Degraaf, Richard M, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Vegetation structure and forest wildlife distribution	640	1.5	3	1	1
2. Atlantic salmon habitat research	130	0	0	5	0
3. Acorn production and ecosystem dynamics	120	1	2	0	3
4. Ecology of seasonal forest ponds	134	1	1	0	0
5. Wildlife-related recreation and natural resources planning	0	0	1	0	0

4251 Wildlife and Fish Habitat Relationships and Recreation Opportunities In New England Forests NE-4251

Problem 1 Vegetation structure and forest wildlife distribution

FY1999 Research Attainment

Publications

Research Unit

DeGraaf, Richard M.; Maier, Thomas J.; Fuller, Todd K. 1999. Predation of small eggs in aritificial nests: effects of nest position, edge, and potential predator abundance in extensive forest. Wilson Bulletin. 111(2): 236-242.

King, David I.; DeGraaf, Richard M.; Griffin, Curtice R. 1998. Edge-related nest predation in clearcut and groupcut stands. Conservation Biology. 12(6): 1412-1415.

King, David I.; DeGraaf, Richard M.; Griffin, Curtice R.; Maier, Thomas J. 1999. Do predation rates on aritificial nests accurately reflect predation rates on natural bird nests? Journal of Field Ornithology. 70(2): 257-262.

Cooperative

King, David I.; Griffin, Curtice R.; DeGraaf, Richard M. 1998. Nest predator distribution among clearcut forest, forest edge and forest interior in an extensively forested landscape. Forest Ecology and Management. 104: 151-156.

Extramural

Griesemer, Sara J.; Fuller, Todd K.; DeGraaf, Richard M. 1998. Habitat use by porcupines (Erethizon dorsatum) in central Massachusetts: effects of topography and forest composition. American Midland Naturalist. 140(2): 271-279

Attainment

We compared nest predation rates on artificial and real birds' nests, and also compared predation at forest edges and interiors in forests under different management systems. Artificial nests are more heavily depredated than real nests, possibly due to parental defense of real nests. Nest placement has a large effect: artificial ground nests are more heavily depredated than shrub nests, while there is no difference between forest interior and at forest edge. The distirubtion of two important nest predator species, red squirrel and eastern chipmunk, are influenced by coniferous tree basal area and the presence of clearcut edges, respectively. Forest edges created by group cutting result in increased levels of predation in adjacent forest, as in clearcutting. The magnitude of this edge effect is similar to that adjacent to clearcuts, but since far less edge is created in clearcuts of similar total area, the abandonment of clearcutting in favor of group selection cannot be justified on the basis of concerns about the welfare of forest-dwelling birds.

4251 Wildlife and Fish Habitat Relationships and Recreation Opportunities In New England Forests NE-4251

Problem 2 Atlantic salmon habitat research

FY1999 Research Attainment

Publications

Extramural

Armstrong, John D.; Grant, James W.A.; Forsgren, Harvey L.; Fausch, Kurt D.; DeGraaf, Richard M.; Fleming, Ian A.; Prowse, Terry D.; Schlosser, Isaac J. 1998. The application of science to the management of Atlantic salmon (Salmo salar): integration across scales. Canadian Journal of Fisheries and Aquatic Sciences. 55(Suppl. 1): 303-311.

Blackwell, Bradley F.; Juanes, Francis. 1998. Predation on Atlantic salmon smolts by striped bass after dam passage. North American Journal of Fisheries Management. 18: 936-939.

Folt, Carol L.; Nislow, Keith H.; Power, Mary E. 1998. Implications of temporal and spatial scale for Atlantic salmon (Salmo salar) research. Canadian Journal of Fisheries and Aquatic Sciences. 55(Suppl. 1): 9-21.

Mather, Martha E.; Parrish, Donna L.; Folt, Carol L.; DeGraaf, Richard M. 1998. Integrating across scales: effectively applying science for the successful conservation of Atlantic salmon (Salmo salar). Canadian Journal of Fisheries and Aquatic Sciences. 55(Suppl. 1): 1-8.

Nislow, Keith H.; Folt, Carol L.; Parrish, Donna L. 1999. Favorable foraging locations for young Atlantic salmon: application to habitat and population restoration. Ecological Applications. 9(3): 1085-1099.

Attainment

The factors that are currently believed to affect the production of anadromous adult salmon (synthesized from current reviews) are arranged in a hierarchy in which any given process overrides those processes at lower levels. The major hierarchies and factors affecting anadromous salmon are: Climate/geology > Geomorphalogy/land use/overfishing> competition among fish/food/space> freshwater growth and survival/marine growth and survival. There is not good correlation between levels in the hierarchy and levels in the hierarchies of scales in space and time for salmon life stages from egg to adult. This indicates the importance of integrating across scales in targeting management actions.

In a specific study of outmigrating fish, predation on smolts by striped bass was documented. More than 48% of striped bass that contained prey had consumed smolts. Atlantic salmon smolts compared more than 80% of the total mass of prey remains recovered, and included both fry-stocked and smolt-stocked individuals.

4251 Wildlife and Fish Habitat Relationships and Recreation Opportunities In New England Forests NE-4251

Problem 3 Acorn production and ecosystem dynamics

FY1999 Research Attainment

Publications

Research Unit

Brooks, Robert T.; Smith, Harvey R.; Healy, William M. 1998. Small-mammal abundance at three elevations on a mountain in central Vermont, USA: a sixteen-year record. Forest Ecology and Management. 110: 181-193.

Healy, William M.; Lewis, Ann M.; Boose, Emery F. 1999. Variation of red oak acorn productions. Forest Ecology and Management. 113: 1-11.

Cooperative

Bauer, Leah S.; Miller, Deborah L.; Maddox, Joseph S.; McManus, Michael L. 1998. Interactions between a Nosema sp. (Microspora: Nosematidae) and nuclear polyhedrosis virus infecting the gypsy moth, Lymantria dispar (Lepidoptera: Lymantriidae). Journal of Invertebrate Pathology. 72: 147-153.

Hain, Fred P.; Hastings, Felton L.; Smith, Harvey R.; Cook, Stephen P.; Monahan, John F. 1998. Interactions among gypsy moths and its predators at the southern edge of infestation. In: Fosbroke, Sandra L.; Gottschalk, Kurt W., Eds. Proceedings, U.S. Department of Agriculture Interagency gypsy moth research forum 1998; 1998 JANUARY 20-23; Annapolis, MD. Gen. Tech. Rep. NE-248. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 24-25. Abstract.

McRoberts, Ronald E.; Brooks, Robert T.; Rogers, Lynn L. 1998. Using nonlinear mixed effects models to estimate size-age relationships for black bears. Canadian Journal of Zoology. 76(1): 1098-1106.

Attainment

Acorn production is characterized by extreme variation among years and among individual trees. The size of acorn crops affects many components of the ecosystem, and both annual and individual variation in acorn production influence the regeneration and management of oak forests. In order to assess the variation within a stand, we sampled the acorn production of 120 red oaks (Subgenus Erythrobalanus) for 11 years. Half of the trees were treated by thinning two years before the study began, and half were unthinned controls. Trees in the thinned part of the stand produced more acorns per tree than those in the unthinned area, but the treatment effect was small in comparison with individual and annual variation. Differences in acorn production between the most productive and least productive individual trees were about 11 fold for thinned and 28 fold for unthinned trees. The largest yearly acorn collection exceeded the smallest by 135 times for the thinned treatment and by 109 times for the unthinned treatment. The two best years (1991, 1993) accounted for 55% of the total 11-year acorn collection, while the 5 poorest years provided only 10% of the total collection, suggesting that efforts to enhance regeneration should coincide with mast years. Thinned and unthinned sample populations exhibited synchronous masting patterns, and good and poor producers within each population also exhibited year-to-year synchrony in acorn production. There was no evidence of cyclic acorn production by this population. Half of the total acorn collection was produced by about one-third of the trees. On average, we were able to identify 87% of the better-than-average acorn producers by monitoring individual tree production for any three consecutive years. This method of identifying superior acorn producers is effective and conceptually simple but it requires at least three years to implement.

4251 Wildlife and Fish Habitat Relationships and Recreation Opportunities In New England Forests NE-4251

Problem 4 Ecology of seasonal forest ponds

FY1999 Research Attainment

Publications

Research Unit Brooks, Robert T.; Stone, Janice; Lyons, Paul. 1998. An inventory of seasonal forest ponds on the Quabbin Reservoir Watershed, Massachusetts. Northeastern Naturalist. 5(3): 219-230.

Attainment A sample of 24 seasonal ("vernal") forest ponds was followed for a second year to assess the effects of pond size and spatial arrangement (isolation) on pond fauna. Water levels in all ponds were monitored periodically from ice melt until the pond dried. Leaf packs for sampling benthic macroinvertebrates, installed in the fall of 1998, were pulled in the late spring. The invertebrates have been sorted from the samples, identified and enumerated. Surveys of catchment topography and vegetation were completed for all ponds. High-water basin profiles, for the calculation of pond volume and surface area, were completed for 14 ponds. Precipitation amount and chemistry were measured weekly at a centrally-located NADP site. Planning for a new study of the effectiveness of Massachusetts forestry BMP's (Best Management Practices) for Vernal Ponds was initiated.

4251 Wildlife and Fish Habitat Relationships and Recreation Opportunities In New England Forests NE-4251

Problem 5 Wildlife-related recreation and natural resources planning

FY1999 Research Attainment

Publications

Research Unit Daigle, John J.; Muth, Robert M.; Zwick, Rodney R.; Glass, Ronald J. 1998. Sociocultural dimensions of trapping: a factor analytic study of trappers in six northeastern states. Wildlife Society Bulletin. 26(3): 614-625.

Attainment No progress to report this period.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England
Eagar, Christopher , Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. How do the cumulative effects of disturbance and atmospheric deposition affect biogeochemistry of nutrient base cations, forest health, and ecosystem function in northern hardwood forests?	412	2	3	0	2
2. What is the range of mineral weathering contributions to nutrient capital in northeastern forests?	173	.8	0	0	2
3. What processes and conditions control the extent to which forest and aquatic ecosystems respond to nitrogen deposition?	254	1.2	2	0	1
4. What are dynamics of community structure, biomass accumulation, and nutrient uptake of northeastern forest ecosystems: how are they effected by disturbances?	94	.5	0	0	1
5. Synthesize knowledge and long-term data bases to develop guidelines for natural resource managers to protect stream quality, etc.	86	.4	2	0	0
M1. Hubbard Brook Experimental Forest will be maintained: for forest ecosystem research; as Biosphere Reserve	190	.5	1	5	0

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem 1 How do the cumulative effects of disturbance and atmospheric deposition affect biogeochemistry of nutrient base cations, forest health, and ecosystem function in northern hardwood forests?

FY1999 Research Attainment

Publications

Research Unit

Briggs, Russell D.; Lemin, Ronald C., Jr.; Hornbeck, James W. 1999. Impacts of precommercial thinning and fertilization on a spruce-fir ecosystem: final report. Res. Bull. 12, Misc. Rep. 408. Orono, ME: University of Maine: 59.

Eagar, Christopher; Bailey, Scott; Bailey, Amey. 1999. Response of northern hardwood forests to nutrient perturbation. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA; U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 89. Abstract.

Fernandez, I.; Rustad, J.; David, M.; Nadelhoffer, K.; Mitchell, M. 1999. Mineral soil and solution responses to experimental N and S enrichment at the Bear Brook Watershed in Maine (BBWM). Environmental Monitoring and Assessment. 55: 165-185.

Cooperative

Bailey, Scott; Horsley, Stephen B.; Long, Robert P.; Hallett, Richard A. 1999. Influence of geologic and pedologic factors on health of sugar maple on the Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 63-65.

Hallett, R.A.; Bailey, S.W.; Horsley, S.B.; Long, R.P.; Hall, T.J. 1999. Foliar chemistry and sugar maple health in the northeastern United States. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 113. Abstract.

Hallett, Richard A.; Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hall, Thomas J. 1999. Foliar chemistry of sugar maple: a regional view. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 66. Abstract.

Horsley, S.; Long, R.; Bailey, S.; Hallett, R.; Hall, T. 1999. Factors contributing to decline-disease of sugar maple in Pennsylvania. In: 84th annual meeting: legacies, landscapes and limits: bridging borders: Ecological Society of America; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 112. Abstract.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A. 1999. Factors contributing to the decline-disease of sugar maple on Pennsylvania's Allegheny Plateau. The Dropline. 2(4): 1.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A.; Hall, Thomas J. 1999. Factors contributing to sugar maple decline along topographic gradients on the glaciated and unglaciated Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen.Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 60-62.

Lawrence, Gregory B.; David, Mark B.; Shortle, Walter C.; Bailey, Scott W.; Lovett, Gary M. 1999. Mechanisms of base-cation depletion in forest soils of the northeastern U.S. In: Horsley, Stephen B.; Long, Robert P. eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 75-87.

Norton, S.; Kahl, J.; Fernandez, I.; Haines, T.; Rustad, L.; Nodvin, S. 1999. The Bear Brook Watershed, Maine (BBWM), USA. Canadian Journal of Forest Research. 55: 7-51.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem 1 How do the cumulative effects of disturbance and atmospheric deposition affect biogeochemistry of nutrient base cations, forest health, and ecosystem function in northern hardwood forests?

FY1999 Research Attainment

Publications

Extramural

Swistock, Bryan R.; DeWalle, David R.; Horsley, Stephen B.; Long, Robert P.; Hall, Thomas J.; Bailey, Scott. 1999. Soil water chemistry in declining and non-declining sugar maple stands. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol 1. The effects of acid deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 63-72.

Attainment

Soil chemical characteristics were studied as indicators of forest ecosystem response to elevated N and S inputs at a paired watershed manipulation experiment in a northern New England forested ecosystem. The study includes two small catchments dominated by northern hardwood forests with red spruce in the upper elevations. Treatments consist of (NH4)2SO4 applied to the West Bear watershed six times per year, increasing N and S deposition 3x and 2x above ambient values, respectively. Most of the treatment effects on mineral soils were evident as higher inorganic S found in the treated watershed soils. Adsorbed SO4 increased by 40% under softwood stands and 50% under hardwood stands. Hardwood soil solutions responded with significant increases in NO3 and SO4 concentrations that resulted in accelerated cation leaching, primarily Ca and Al.

Decline of sugar maple has been a problem on the Allegheny Plateau of Pennsylvania since the mid-1980's. A study was initiated to examine soil factors leading to sugar maple decline on the Allegheny Plateau. Nutrition appears to be a predisposing factor in sugar maple decline on the Allegheny Plateau. Declining stands are marked by low foliar calcium and magnesium concentrations, which follow low concentrations of extractable pools of these elements in the soil.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem 2 What is the range of mineral weathering contributions to nutrient capital in northeastern forests?

FY1999 Research Attainment

Publications

Cooperative

Hislop, J.E.; Hornbeck, J.W.; Bailey, S.W.; Hallett, R.A.1998. Development of internal forest soil reference samples and testing of digestion methods. Communications in Soil Science and Plant Analysis. 29(11-14): 1991-1996.

Attainment

Watershed mass balance studies have shown that acid deposition and intensive forest harvesting can remove significant amounts of critical plant nutrients at some sensitive sites. Little is known about the location and extent of sensitive sites at the landscape level. We are developing a method to predict spatial patterns in sensitivity to nutrient depletion. The till source model predicts the lithologic source of soil parent material in glaciated terrain. This past year, the model was enhanced by development of a database of bedrock mineralogy and chemistry for all bedrock map units in northern New Hampshire and adjacent portions of Vermont and Maine. Computer code was written which allows the till source model to use this database to predict soil chemistry and mineralogy. The model is run within a geographic information system. Draft maps of soil chemistry for the White Mountain National Forest have been produced. Ongoing activities include soil chemical analyses from samples collected across the WMNF to calibrate the model. Finally, validation sampling is planned to confirm that predictions of sensitive and insensitive sites are valid. This will provide an invaluable tool to managers of the White Mountain National Forest to adjust management plans to better protect long-term soil quality and site productivity.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem 3 What processes and conditions control the extent to which forest and aquatic ecosystems respond to nitrogen deposition?

FY1999 Research Attainment

Publications

Research Unit

Aber, John; McDowell, William; Nadelhoffer, Knute; Magill, Alison; Berntson, Glenn; Kamakea, Mark. 1998. Nitrogen saturation in temperate forest ecosystems. Bioscience. 48(11): 921-934.

Pardo, Linda. 1999. Natural abundance of 15N as a tool for assessing patterns of nitrogen loss from forest ecosystems. Massachusetts Institute of Technology: Ph.D. Dissertation. 136.

Cooperative

Kahl, J.; Norton, S.L.; Fernandez, I.; Rustad, L.; Handley, M. 1999. Nitrogen and sulfur input-output budgets in the experimental and reference watersheds, Bear Brook watershed in Maine (BBWM). Environmental Monitoring and Assessment. 55: 113-131.

Attainment

Stable isotopes provide an integrated measure of the nitrogen cycling history of a site. Among ecosystems with contrasting nitrate loss patterns, the del 15N of soil and plant material should be higher at sites with higher nitrate losses. An underlying assumption in natural abundance isotope studies is that soil del 15N is at steady-state over time. Our research found that del 15N was not at steady state in either the Oie or Oa horizon for the period 1969 to 1992 for the reference watershed (W6) at the Hubbard Brook Experimental Forest (HBEF); when nitrate losses were high, del 15N increased. The del 15N of soils was measured from 28 soil pits at Watershed 5 at the HBEF before and after clear-cutting in order to test the hypothesis that elevated nitrification and nitrate loss induced by clear-cutting would be associated with a concurrent increase in soil del 15N. A mass-balance model confirmed that increases in nitrification and nitrate loss after clear-cutting could explain the increase in soil del 15N in the organic horizons after 3 years. Increased foliar del 15N coincided with increased streamwater nitrate concentration, suggesting that the increased nitrification that caused elevated streamwater nitrate concentration also caused enrichment of the plant-available ammonium pool.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem 4 What are dynamics of community structure, biomass accumulation, and nutrient uptake of northeastern forest ecosystems: how are they effected by disturbances?

FY1999 Research Attainment

Publications

Cooperative

Cromack, Kermit, Jr.; Miller, Richard E.; Helgerson, Ole T.; Smith, Richard B.; Anderson, Harry W. 1999. Soil carbon and nutrients in a coastal Oregon Douglas-fir plantation with red alder. Soil Science Society of America Journal. 63(1): 232-239.

Hornbeck, James W.; Kochenderfer, James N.1998. Growth trends and management implications for West Virginia's red spruce forests. Northern Journal of Applied Forestry. 15(4): 197-202.

Attainment

Growth trends determined from tree rings are reported for red spruce in three mature stands and three plantations in West Virginia. Annual growth rates in mature forests have stablized after a period of decline that began around 1960 and lasted for 20-25 yr. Annual growth rates in plantations established between 1935 and 1942 show a gradual decline that can be reversed by thinning. Growth rates and stand basal areas suggest that red spruce forests in West Virginia are healthy and can be highly productive. Management options for expanding the area of red spruce forests include harvesting to encourage or release regeneration, and establishment by planting.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem 5 Synthesize knowledge and long-term data bases to develop guidelines for natural resource managers to protect stream quality, etc.

FY1999 Research Attainment

Publications

Research Unit

Hornbeck, J.W.; Bailey, S.W.; Buso, D.C.; Shanley, J.B. 1999. Streamwater chemistry: a useful tool for forest managers. In: Olsen, Darren S.; Potyondy, John P., eds. Wildland hydrology: AWRA symposium proceedings; 1999 JUNE 30-JULY 2; Bozeman, MT. TPS-99-3. Herndon, VA: American Water Resources Association: 361-367.

Kochenderfer, James N.; Hornbeck, James W. 1999. Contrasting timber harvesting operations illustrate the value of BMPS. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 128-136.

Nicholas, Niki Stephanie; Eagar, Christopher; Peine, John D. 1999. Threatened ecosystem: high elevation spruce-fir forest. In: Peine, John D., comp., ed. Ecosystem management for sustainability: principles and practices illustrated by a regional biosphere research cooperative. Boca Raton, FL: CRC Press LLC: 431-454.

Attainment

The chemical composition of forest streams in New England varies widely among watersheds, depending upon m ineral weathering, soil and hydrologic characteristics, vegetation, climate, biological processes, and natural and human disturbances. To illustrate, a summary of stream chemical data from 159 upland, forested watersheds in central New England showed ranges of 3.5 to 7.8 for pH, 2 to >1,000 ueq/L for Ca2+, 37 to 250 ueq/L for SO42-, and ~0 to 54 ueq/L for NO3-. In essence, the variability is wide enough that even forest streams can be looked upon as having a unique chemical signature. A more intensive study of 3 watersheds used in the summary suggests that chemical signatures of forest streams may provide useful indices of nutrient status and cycling processes occurring in forested watersheds. For example, low concentrations of base cations in streams, especially Ca2+, suggest that watershed capitals may be depleted, possible due to past disturbances, or due to low contributions from mineral weathering. The Ca:Al ratios of forest streams may be used to assess whether there might be nutrient imbalances and forest health problems. Concentrations of NO3- are indicative of the status of waterhshed N and whether N saturation may be occurring. Forest managers can use this information to help make informed decisions about the intensity and frequency of harvesting, and to evaluate susceptibility of forest and stream ecosystems to atmospheric deposition.

4352 Ecological Processes: A Basis for Managing Forests and Protecting Water Quality in New England NE-4352

Problem M1 Hubbard Brook Experimental Forest will be maintained: for forest ecosystem research; as Biosphere Reserve

FY1999 Research Attainment

Publications

Research Unit

Amthor, Jeffrey S. 1999. Rising CO2 and forest water use: long-term data from Hubbard Brook Experimental Forest, New Hampshire. In: Adams, D. Briane, ed. Potential consequences of climate variability and change to water resources of the United States: AWRA symposium proceedings; 1999 MAY 10-12; Herndon, VA. Herndon, VA: American Water Resources Association: 399-402.

Extramural

Amthor, J.S. 1998. Searching for a relationship between forest water use and increasing atmospheric CO2 concentration with long-term hydrologic data from the Hubbard Brook Experimental Forest. In: Environ. Sci. Div. Publ. No. 4833. Oak Ridge, TN: Oak Ridge National Laboratory: 25.

Arthur, M.A.; Siccama, T.G.; Yanai, R.D. 1999. Calcium and magnesium in wood of northern hardwood forest species: relations to site characteristics. Canadian Journal of Forest Research. 29: 339-346.

Holmes, Richard T.; Likens, Gene E., comps. 1999. Organisms of the Hubbard Brook Valley, New Hampshire. In: Gen. Tech. Rep. NE-257. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 32.

Rosenberry, D.O.; Bukaveckas, P.A.; Buso, D.C.; Likens, G.E.; Shapiro, A.M.; Winter, T.C. 1999. Movement of road salt to a small New Hampshire lake. Water, Air, and Soil Pollution. 109: 179-206.

Tierney, Geraldine L.; Fahey, Timothy J. 1998. Soil seed bank dynamics of pin cherry in a northern hardwood forest, New Hampshire, USA. Canadian Journal of Forest Research. 28: 1471-1480.

Attainment

Improving estimates of the nutrient content of boles in forest ecosystems requires more information on how the chemistry of wood varies with characteristics of the tree and site. We examined Ca and Mg concentrations in wood at the Hubbard Brook Experimental Forest. Species examined were the dominant tree species of the northern hardwood forest and the spruce-fir forest. There were significant patterns in Ca and Mg concentrations with wood age. The size of the tree was not an important source of variation. Beech showed significantly greater concentrations of both Ca (30%) and Mg (33%) in trees growing in moist sites relative to drier sites; sugar maple and yellow birch were less sensitive to mesotopography. In addition to species differences in wood chemistry, Ca and Mg concentrations in wood decreased with increasing elevation, coinciding with a pattern of decreasing Ca and Mg in the forest floor. Differences in Ca and Mg concentration in wood accounted for by elevation ranged from 12 to 23% for Ca and 16 to 30% for Mg for the three northern hardwood species. At the ecosystem scale, the magnitude of the elevational effect on wood chemistry, weighted by species, amounts to 18% of wood Ca in the watershed and 24% of wood Mg but only 2% of aboveground biomass Ca and 7% of aboveground Mg.

4353 Sustainable Forest Ecosystems in the Central Appalachians
Adams, Mary Beth, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Info is needed on historical disturbance patterns and influences on ecosystem processes	138	1.1	4	0	0
2.	Quantitative information is needed about important ecosystem processes and impacts of disturbances	597	1.7	6	8	0
3.	Efficient and ecologically sound silvicultural alternatives must be developed to meet complex management objectives and provide for sustainable production and availability of many forest benefits	337	1.6	2	0	2
4.	Develop guidelines for a variety of management and operation practices and develop tools to monitor, evaluate and mitigate impacts on soil productivity, water quality and quantity	675	1.6	3	3	0

4353 Sustainable Forest Ecosystems in the Central Appalachians NE-4353

Problem 1 Info is needed on historical disturbance patterns and influences on ecosystem processes

FY1999 Research Attainment

Publications

Research Unit

Edwards, Pamela J.; Carnahan, Donna L.; Henderson, Zachary. 1999. Channel cross-section and substrate comparisons among four small watersheds with different land-disturbance histories. In: Olsen, Darren S.; Potyondy, John P., eds. Proceedings, specialty conference: wildland hydrology; 1999 JUNE 30-JULY 2; Bozeman, MT. Herndon, VA: American Water Resources Association: 217-218. Abstract.

Schuler, T.M.; Fajvan, M.A. 1999. Understory characteristics and disturbance history of a central Appalachian forest prior to old-growth harvesting circa 1900. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 190. Abstract.

Schuler, Thomas M. 1998. Pattern of oak regeneration in a central Appalachian forest. Purdue University: Ph.D. Dissertation. 121.

Schuler, Thomas Myrl; Fajvan, Mary Ann. 1999. Understory tree characteristics and disturbance history of a central Appalachian forest prior to old-growth harvesting. Res. Pap. NE-710. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 12.

Attainment

Considerable progress was made in understanding the characteristics of oak regeneration and species composition changes over time in a central Appalachian forest in West Virginia. A decline in diversity and evenness of woody species from 1922 to 1997 was documented and found to be correlated with an increase in importance of sugar maple, regardless of disturbance regime. The understory characteristics of the old-growth forest prior to turn-of-the-century logging were also documented: oak recruitment prior to old-growth harvesting appeared to be continuous from an ephemeral pool of small seedling-size stems less than about 20 years of age. A median standwide canopy disturbance interval was estimated as 33.8 years during the period 1738 to 1993.

4353 Sustainable Forest Ecosystems in the Central Appalachians NE-4353

Problem 2 Quantitative information is needed about important ecosystem processes and impacts of disturbances

FY1999 Research Attainment

Publications

Research Unit

Adams, Mary Beth. 1999. Acidic deposition and sustainable forest management in the central Appalachians, USA. Forest Ecology and Management. 122: 17-28.

Adams, Mary Beth; Kochenderfer, James N. 1999. The Fernow whole-watershed acidification study: soil chemistry. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference, Vol. I. The effects of acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 119-127.

Edwards, Pamela J.; Gregory, James D.; Allen, H. Lee. 1999. Seasonal sulfate deposition and export patterns for a small Appalachian watershed. Water, Air, and Soil Pollution. 110: 137-155.

Edwards, Pamela J.; Kochenderfer, James N.; Helvey, J. David. 1999. Soil water and stream water acidification caused by nitrogen and sulfur amendments. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol. I. The effects of acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 91-105.

Ford, W.M.; Hale, P.E.; Odom, R.H.; Chapman, B.R. 1999. Stand-age, stand characteristics, and landform effects on understory herbs in cove-hardwoods. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: foresty ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 96. Abstract.

Wooten, Alexander C.; Preer, James; Edwards, Pamela J. 1999. Geologic and tributary influences on the chemistry of a headwater stream. Res. Pap. NE-708. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 7.

4353 Sustainable Forest Ecosystems in the Central Appalachians NE-4353

Problem 2 Quantitative information is needed about important ecosystem processes and impacts of disturbances

FY1999 Research Attainment

Publications

Extramural

DeWalle, David R.; Tepp, Jeffrey S.; Swistock, Bryan R.; Sharpe, William E.; Edwards, Pamela J. 1999. Tree-ring cation response to experimental watershed acidification in West Virginia and Maine. Journal of Environmental Quality. 28(1): 299-309.

Gilliam, Frank S.; Adams, Mary Beth. 1999. Effects of harvesting on soil nitrogen (N) dynamics in a N-saturated hardwood forest. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 29-36.

Laerm, Joshua; Carter, Timothy C.; Menzel, Michael A.; McCay, Timothy S.; Boone, James L.; Ford, W. Mark. 1999. Amphibians, reptiles, and mammals of Sapelo Island, Georgia. Journal of the Elisha Mitchell Scientific Society. 115(2): 104-126.

Peterjohn, William T.; Christ, McGervey, Richard J.; Sexstone, Alan J.; Christ, Martin J.; Foster, Cassie J.; Adams, Mary B. 1999. Nitrous oxide production in two forested watersheds exhibiting symptoms of nitrogen saturation. Canadian Journal of Forest Research. 28: 1723-1732.

Peterjohn, William T.; Foster, Cassie J.; Christ, Martin J.; Adams, Mary B. 1999. Patterns of nitrogen availability within a forested watershed exhibiting symptoms of nitrogen saturation. Forest Ecology and Management. 119: 247-257.

Schweitzer, Callie Jo; Sharpe, William E.; Edwards, Pamela J.. The effect of soil manganese on Japanese larch (Larix leptolepis Sieb. and Zucc.) seedlings in the greenhouse. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 240-244.

Toure, Oumar; Petersen, Raymond L.; Edwards, Pamela J. 1999. The apparent adaptation of the pigeon moss, Polytrichum commune Hedw. (Polytrichaceae) to soils affected by acid mine drainage. The ASB Bulletin. 46(2): 173. Abstract.

Williard, Karl W.J.; DeWalle, David R.; Sharpe, Peter J.; Edwards, Pamela J.; Adams, Mary Beth. 1999. Spatial variations in stream nitrate concentrations in a region containing a nitrogen saturated watershed. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol. II. The effects of acidic deposition on aquatic ecosystems in Pennsylvania; 1998 SEPTEMBER 14-18; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 23-30.

Attainment

The continuation of the Fernow Whole Watershed Acidification Study allowed improved understanding of nutrient dynamics in forests which receive high levels of atmosphere deposition. Net production of nitrous oxide (N2O, a greenhouse gas) was found to have increased as a result of nitrogen saturation. Nitrogen availability within a forested watershed was found to be correlated with aspect and woody species composition. Base cation depletion was documented through analysis of acid anion/base cation ratios in soil leachate. In a related study, the patterns of sulfate deposition and movement were documented in a small headwater catchment, and it was found that dormant season sulfate losses resulted from progressive depletion of the anion through the soil profile.

Concerns have arisen about base cation depletion of central Appalachian forest soils through the combined effects of acidic deposition and intensive forest harvesting and long-term studies initiated to address these concerns. Progress has been made in documenting the effects on N cycling in the first few years. Harvesting did not increase the rate of net N cycling, but additions of lime did increase cycling rates.

4353 Sustainable Forest Ecosystems in the Central Appalachians NE-4353

Problem 3 Efficient and ecologically sound silvicultural alternatives must be developed to meet complex management objectives and provide for sustainable production and availability of many forest benefits

FY1999 Research Attainment

Publications

Research Unit

Castleberry, Steven B.; Ford, W. Mark; Miller, Karl V.; Smith, Winston P. 1999. White-tailed deer browse preferences in a southern bottomland hardwood forest. Southern Journal of Applied Forestry. 23(2): 78-82.

Schuler, Thomas M.; Miller, Gary W. 1999. Releasing shelered northern red oak during the early stem exclusion stage. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 195-201.

Cooperative

Hornbeck, James W.; Kochenderfer, James N.1998. Growth trends and management implications for West Virginia's red spruce forests. Northern Journal of Applied Forestry. 15(4): 197-202.

Johnson, James E.; Miller, Gary W.; Baumgras, John E.; West, Cynthia D. 1998. Assessment of residual stand quality and regeneration following shelterwood cutting in central Appalachian hardwoods. Northern Journal of Applied Forestry. 15(4): 203-210.

Perkey, Arlyn W.; Miller, Gary W.; Schuler, Thomas M. 1999. Regeneration results using two-aged management. In: For. Manage. Update 19. Morgantown, WV: U.S. Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry: 25.

Attainment

Knowledge about a number of silvicultural techniques was advanced. Regeneration following shelterwood-with-reserves cutting was found to closely resemble that following clearcutting, containing a mix of tolerant and shade tolerant species, although some care must be taken in marking and harvesting to assure success. Management guidelines for such two-aged management were developed. Northern red oaks grown in tree shelters may be an effective way of retaining red oak as a competitive species in Appalachian forests, if the sheltered trees are released during the early stem exclusion stage. Red spruce growth was compared in mature natural stands and in plantations. Growth rates in natural stands have stabilized following a 25-year period of decline. This analysis showed that red spruce forests in West Virginia are healthy and can be highly productive, given proper management. White-tailed deer browse preferences were identified for a southern bottomland hardwood forest, and were found to have a relatively minor effect on regeneration in this particular setting.

4353 Sustainable Forest Ecosystems in the Central Appalachians NE-4353

Problem 4 Develop guidelines for a variety of management and operation practices and develop tools to monitor, evaluate and mitigate impacts on soil productivity, water quality and quantity

FY1999 Research Attainment

Publications

Research Unit

Angradi, Ted R. 1999. Fine sediment and macroinvertebrate assemblages in Appalachian streams: a field experiment with biomonitoring applications. Journal of North American Benthological Society. 18(1): 49-66.

Kochenderfer, James N.; Hornbeck, James W. 1999. Contrasting timber harvesting operations illustrate the value of BMPS. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 128-136.

Thomasma, Linda Ebel; Peterson, Rolf O. 1998. Tool and technique for restraining live-captured American martens and fishers. Res. Note NE-365. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 5.

Extramural

Adams, Mary Beth; Ramakrishna; Kilaparti; Davidson, Eric A., eds. 1998. The contribution of soil science to the development of and criteria and indicators of sustainable forest management. In: SSA Spec. Publ. 53. Madison, WI: Soil Science Society of America: 156.

Davidson, Eric A.; Ramakrishna, Kilaparti; Adams, Mary Beth. 1998. Epilogue. In: The contributions of soil science to the development of and implementation of criteria and indicators of sustainable forest management. SSSA Spec. Publ. 53. Madison, WI: Soil Science Society of America: 155-156.

DeWalle, David R.; Swistock, Bryan R.; Tepp, Jeffrey S.; Sharpe, William E.; Edwards, Pamela J. 1999. Dendrochemical detection of base cation depletion and watershed acidification. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference, Vol. I. The effects of acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 129-136.

Attainment

Methods were developed and tested for monitoring a variety of ecosystem properties. In both experimental and survey studies, stream macroinvertebrate assemblages were found to be sensitive to amounts of fine sediment in streams, suggesting that some metrics have applicability for biomonitoring at a regional scale. Dendrochemical (tree-ring chemistry) monitoring was generally not found to be an effective tool for monitoring changes in forest chemical environment for 6 of 8 tree species tested.

BMPs (Best Management Practices) for protecting soils and streams were demonstrated to be effective in significantly reducing water quality impacts. A discussion on the contribution of soil science to the development and implementation of criteria and indicators of sustainable forest management was published. This discussion involved forest soil scientists from around the globe, meeting to address the question of how sustainable forest management can be implemented and assessed.

Research Unit NE-4454

Integrating Social and Biophysical Sciences for Natural Resource Management
Twery, Mark J, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Social structures and processes: Resource managers need an improved understanding of the relationships among social institutions and organizations, forest management, and forest ecosystem processes to achieve their policy and management goals	221	2	6	0	0
2.	Values and decision making: Natural resource managers need a better understanding of key human values that affect natural resource decisions and better tools for analyzing and evaluating alternative policies and management actions, particularly those...	160	2	7	0	0
3.	Management applications: Natural resource managers face critical information gaps about an array of human social values regarding timber management, recreation, special forest products and biodiversity and the interactions of these values with management	363	2	8	1	4
4.	Tool development: There is a need for decision support tools that integrate the best knowledge available about biophysical and social systems and assist managers and policy makers in using this knowledge to make decisions.	357	1	3	0	1

4454 Integrating Social and Biophysical Sciences for Natural Resource Management NE-4454

Problem 1 Social structures and processes: Resource managers need an improved understanding of the relationships among social institutions and organizations, forest management, and forest ecosystem processes to achieve their policy and management goals

FY1999 Research Attainment

Publications

Research Unit

Brooks, Cali.; Emery, Marla; McCarthy, James; Smith, Dan; Tam, Laura. 1999. Rural regions, identity and politics: the cultural and ecological significance of place. In: Conference on the Adirondacks and the Lake Champlain Basin; 1999 MAY 26-27; Saranac Lake, NY. Paul Smiths, NY: Paul Smith's College: 11. Abstract.

Burch, William R., Jr.; Grove, J. Morgan. 1999. Ecosystem management--some social and operational guidelines for practitioners. In: Johnson, N.C.; Malk, A.J.; Sexton, W.T.; Szaro, R., comps., eds. Ecological stewardship: a common reference for ecosystem management. Oxford, England: Elsevier Science Ltd.: 279-295.

Emery, Marla; Malaret, Luis; Rocheleau, Dianne. 1999. Social constituencies of Adirondacks ecologies. In: Conference on the Adirondacks and the Lake Champlain Basin; 1999 MAY 26-27; Saranac Lake, NY. Paul Smiths, NY: Paul Smith's College: 16. Abstract.

Parker, J. Kathy; Sturtevant, Victoria E.; Shannon, Margaret A.; Burch, William R., Jr.; Grove, J. Morgan; Ingersoll, Jeremiah C.; Sagel, Lois. 1999. Some contributions of social theory to ecosystem management. In: Johnson, N.C.; Malk, A.J.; Sexton, W.T.; Szaro, R., comps., eds. Ecological stewardship: a common reference for ecosystem management. Oxford, England: Elsevier Science Ltd.: 245-277.

Stevens, T. H.; Belkner, R.; Kittredge, D.; Dennis, D.; Willis, C. 1998. Willingness to participate in ecosystem management of NIPF lands in the Northeast. In: Jakus, Paul M., comp. Benefits and cost of resource policies effecting public and private land. Western Reg. Res. Publ. W-133; 11th Interim Rep. Knoxville, TN: University of Tennessee, Department of Agricultural Economics and Rural Sociology: 313-349.

Stevens, T.H.; Dennis, D.; Kittredge, D.; Rickenbach, M. 1999. Attitudes and preferences toward co-operative agreements for management of private forestlands in the north-eastern United States. Journal of Environmental Management. 55: 81-90.

Attainment

We have developed strong theoretical works on the relationships of social institutions and processes to the ecosystem within which they operate, from central urban environments to remote rural areas. Additional publications on the relationships of communities to their ecological surroundings demonstrate the basis for the theoretical work. We have documented the attitudes of nonindustrial private forest landowners toward ecosystem management and identified the effects that these attitudes may have on implementation of landscape or regional management goals.

4454 Integrating Social and Biophysical Sciences for Natural Resource Management NE-4454

Problem 2 Values and decision making: Natural resource managers need a better understanding of key human values that affect natural resource decisions and better tools for analyzing and evaluating alternative policies and management actions, particularly those...

FY1999 Research Attainment

Publications

Research Unit

Dennis, Donald F. 1999. Do resource managers differ from the public in their preferences for management alternatives? In: Vogelsong, Hans G., comp., ed. Proceedings of the 1998 northeastern recreation research symposium; 1998 APRIL 5-7; Bolton Landing, NY. Gen. Tech. Rep. NE-255. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 130-134.

Dennis, Donald F. 1999. Professional and gender value differences in resource management decisions. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of the Canadian and Northeastern Forest Economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service, Atlantic Forestry Centre: 84-93.

Dennis, Donald F.; Stevens, Thomas H.; Kittredge, David B.; Rickenbach, Mark G. 1999. Nonindustrial private forests: perspectives on ecosystem management. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of the Canadian and Northeastern Forest Economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service, Atlantic Forestry Centre: 173-179.

Glass, Ronald J.; More, Thomas A. 1999. Satisfaction, valuation, and views toward allocation of Vermont goose hunting opportunities. In: Rusch, Donald H.; Samuel, Michael D.; Humbrug, Dale D.; Sullivan, Brian D., eds. Biology and management of Canada geese: Proceedings of the international Canada goose symposium; 1991 APRIL 23-25; Milwaukee, WI. [Place of publication unknown]: [Publisher name unknown]: 402. Abstract.

Glass, Ronald J.; Stevens, Thomas H.; More, Thomas A. 1999. Incorporating broad-based values into natural resource decision making: conceptual and measurement challenges. In: Vogelsong, Hans G., comp., ed. Proceedings of the 1998 northeastern recreation research symposium; 1998 APRIL 5-7; Bolton Landing, NY. Gen. Tech. Rep. NE-255. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 204-209.

More, Thomas A. 1998. User fees and public objectives in recreation management. Trends. 35(2): 23-26.

More, Thomas A. 1999. Pricing public-sector recreation: a functionalist perspective. In: Vogelsong, Hans G., comp., ed. Proceedings of the 1998 northeastern recreation research symposium; 1998 APRIL 5-7; Bolton Landing, NY. Gen. Tech. Rep. NE-255. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Reserch Station: 107-110.

Attainment

We continue to produce information on how the public values various resources from their public lands, and what tradeoffs they are willing to make. We have published extensively on user fees and their relationship to fair distribution of use of public lands. We have demonstrated the importance of solitude as a value that people want from their forest lands. Additional work on the value of parks continues to provide managers with important information.

4454 Integrating Social and Biophysical Sciences for Natural Resource Management NE-4454

Problem 3 Management applications: Natural resource managers face critical information gaps about an array of human social values regarding timber management, recreation, special forest products and biodiversity and the interactions of these values with management

FY1999 Research Attainment

Publications

Research Unit

Bove, James R.; Twery, Mark J.; Wade, Gary; Detmar, Kathie; Fahey, Linda. 1999. The effects of five silvicultural treatments on ground flora, overstory composition, and stand structure: a case study in a northern hardwood forest in the northern Adirondacks. In: Conference on the Adirondacks and the Lake Champlain Basin; 1999 MAY 26-27; Saranac Lake, NY. Paul Smiths, NY: Paul Smith's College: 8. Abstract.

Emery, Marla R. 1999. Human ecology of non-timber forest products: results of a rural U.S. case study. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 91. Abstract.

Emery, Marla R. 1999. Sell globally, buy locally: non-timber forest product commodity chains in northern Michigan. In: Association of American Geographers 95th annual meeting; 1999 MARCH 23-27; Honolulu, HI. Washington, DC: Association of American Geographers. Abstract. [on cd-rom].

MacFarlane, Derek; Dennis, Donald F., eds. 1999. Proceedings of the joint meeting of the Canadian and Northeastern Forest Economists. 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service, Atlantic Forestry Centre: 262.

Wade, G.L. 1999. Inventory monitoring and information to support ecosystem management. In: Eckhoff, Janet D., eds. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine; 211. Abstract.

Wade, G.L.; Thompson, R.L. 1999. Woody vegetation and succession on the Fonde Surface Mine Demonstration Area, Bell County, Kentucky. In: Bengson, Stuart A.; Bland, Douglas M., eds. Proceedings of the 16th annual national meeting of the American Society for Surface Mining and Reclamation: mining and reclamation for the next millennium; 1999 AUGUST 13-19; Scottsdale, AZ. Rio Rancho, NM: American Society for Surface Mining and Reclamation: 339-351.

Wade, Gary L. 1998. RNA-related work. Natural Areas Report. 10(1): 3, 8.

Withers, Mark A.; Palmer, Michael W.; Wade, Gary L.; White, Peter S.; Neal, Paul R. 1998. Chapter 4: Changing patterns in the number of species in North American floras. In: Sisk, Thomas D., comp., ed. Perspectives on the land use history of North America: a context for understanding our changing environment. Biol. Sci. Rep. USGS/BRD/BSR-1998-003. Washington, DC: U.S. Department of the Interior, U.S. Geological Survey, Biological Resources Division: 23-31.

Cooperative

Dennis, Donald F.; Sendak, Paul E.; McEvoy, Thomas J. 1999. Stumpage prices in Vermont and New Hampshire. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of the Canadian and Northeastern Economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service; Atlantic Forestry Centre: 246-248.

Emery, Marla R. 1998. Invisible livelihoods: non-timber forest products in Michigan's Upper Peninsula. Rutgers University: Ph.D. Dissertation. 291.

Gottschalk, K.W.; Muzika, R.M.; Twery, M.J. 1999. Disturbance from gypsy moth defoliation and mortality: mediation by silvicultural treatments. In: Cook, J.E.; Oswald, B.P., comps. First biennial North American forest ecology workshop; 1997 JUNE 24-26; Raleigh, NC. Raleigh, NC: North Carolina State University: 381. Abstract.

Gottschalk, Kurt W.; Muzika, Rose-Marie; Twery, Mark J. 1999. Managing forests for gypsy moth (Lymantria dispar L.) using silviculture: testing the effectiveness of silvicultural treatments in reducing defoliation and mortality. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 270. Abstract.

4454 Integrating social and biophysical sciences for natural resource management NE-4454

Problem 3 Management applications: Natural resource managers face critical information gaps about an array of human social values regarding timber management, recreation, special forest products and biodiversity and the interactions of these values with management

FY1999 Research Attainment

Publications

Extramural Vogelsong, Hans G., comp., ed. Proceedings of the 1998 northeastern recreation research symposium; 1998 APRIL 5-7; Bolton Landing, NY. In: Gen. Tech. Rep. NE-255. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Reserch Station: 253.

Attainment We continue to develop and refine our understanding of how ecological relationships vary across scales from individual stands to landscape and regional levels. Restoration of ecosystem function on abandoned surface mines is an important problem for which we have provided needed information. Additional work on scale-dependent analysis of human-dominated ecosystems, such as Baltimore, MD, is producing new information on how human and ?natural? ecosystems are actually an integrated whole. We have developed extensive information on how people use the forested environment to support their livelihoods in rural, poor communities.

4454 Integrating Social and Biophysical Sciences for Natural Resource Management NE-4454

Problem 4 Tool development: There is a need for decision support tools that integrate the best knowledge available about biophysical and social systems and assist managers and policy makers in using this knowledge to make decisions.

FY1999 Research Attainment

Publications

Research Unit

Grove, J. Morgan. 1999. Tools for exploring new approaches in human ecosystem and landscape research: geographic information systems, remote sensing, and computer modeling. In: Cordell, H. Ken; Bergstrom, John C., comps., eds. Integrating social sciences with ecosystem management: human dimensions in assessment, policy, and management. Champaign, IL: Sagamore Publishing: 219-236.

Oliver, Chadwick D.; Twery, Mark J. 1999. Decision support systems/models and analyses. In: Johnson, N.C.; Malk, A.J.; Sexton, W.T.; Szaro, R., comps., eds. Ecological stewardship: a common reference for ecosystem management. Oxford, England: Elseview Science Ltd.: 661-685.

Potter, W.D.; Bi, W.; Twardus, D.; Thistle, H.; Twery, M.J.; Ghent, J.; Teske, M. 1999. Intelligent decision support for aerial spray deposition management. In: Environmental decision support systems and artificial intelligence: papers from the AAAI workshop; 1999 JULY 18; Orlando, FL. Tech. Rep. WS-99-07. Menlo Park, CA: AAAI Press: 23-29.

Cooperative

Nute, Donald; Kim, Geneho; Potter, Walter D.; Twery, Mark J.; Rauscher, Michael; Thomasma, Scott; Bennett, Deborah; Kollasch, Peter. 1999. A multi-criterial decision support system for forest management. In: Environmental decision support systems and artificial intelligence: papers from the AAAI workshop; 1999 JULY 18; Orlando, FL. Tech. Rep. WS-99-07. Menlo Park, CA: AAAI Press: 74-81.

Attainment

Progress this year includes distribution of hundreds of copies of software to promote better-informed decision making for ecosystem management. New software developed explores the methodology of analyzing multi-resource decisions and assists managers in balancing objectives. A better understanding of how goals for management can be constructed and how they may be interrelated has resulted from our work this year. Additional research into using a genetic algorithm to determine the best combination of spray equipment has produced information of great use to aerial applicators.

Research Unit NE-4455

Global Change Research Program
Birdsey, Richard A, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Global Change Research	1,749	6.5	1	15	6
2. Global Change Research (Continued)	0	0	1	7	5

4455 Global Change Research Program NE-4455

Problem 1 Global Change Research

FY1999 Research Attainment

Publications

Research Unit

Brooks, Robert T.; Stone, Janice; Lyons, Paul. 1998. An inventory of seasonal forest ponds on the Quabbin Reservoir Watershed, Massachusetts. Northeastern Naturalist. 5(3): 219-230.

Jenkins, Jennifer C.; Aber, John D.; Canham, Charles D. 1999. Hemlock woolly adelgid impacts on community structure and N cycling rates in eastern hemlock forests. Canadian Journal of Forest Research. 29: 630-645.

Loats, K.V.; Rebbeck, J. 1999. Interactive effects of ozone and elevated carbon dioxide on the growth and physiology of black cherry, green ash, and yellow-poplar seedlings. Environmental Pollution. 106: 237-248.

Cooperative

Emery, Marla R. 1998. Invisible livelihoods: non-timber forest products in Michigan's Upper Peninsula. Rutgers University: Ph.D. Dissertation. 291.

Fast, Jerome D.; Heilman, Warren E.; Bian, Xindi. 1998. Weather patterns associated with high ozone concentrations in the Great Lakes region. In: 23rd conference on agricultural & forest meteorology, 13th conference on biometeorology and aerobiology, and 2nd urban environment symposium; 1998 NOVEMBER 2-6; Albuquerque, NM. Boston, MA: American Meteorological Society: 333-335.

Haack, Robert A.; Poland, Therese M.; Heilman, Warren E. 1998. Using historical temperature records to adjust the federal quarantine of the pine shoot beetle. In: 23rd conference on agricultural & forest meteorology, 13th conference on biometeorology and aerobiology, and 2nd urban environment symposium; 1998 NOVEMBER 2-6; Albuquerque, NM. Boston, MA: American Meteorological Society: 319-322.

Liebhold, Andrew; Muzika, Rose-Marie; Sharov, Alexei; Williams, David. 1998. Landscape-level approaches to understanding gypsy moth population ecology. Recent Research Developments in Entomology. 2: 87-102.

Nungesser, Martha K.; Joyce, Linda A.; McGuire, A. David. 1999. Effects of spatial aggregation on predictions of forest climate change response. Climate Research. 11: 109-124.

Potter, Brian E.; Cate, Thomas W. 1999. A climatology of late-spring freezes in the northeastern United States. In: Gen. Tech. Rep. NC-204. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 35.

Zasada, J.C.; Teclaw, R.M.; Buckley, D.S.; Isebrands, J.G. 1999. Effects of frost on hardwood regeneration in northern Wisconsin. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 17-24.

4455 Global Change Research Program NE-4455

Problem 1 Global Change Research

FY1999 Research Attainment

Publications

Extramural

Calanni, J.; Berg E.; Wood, M.; Mangis, D.; Boyce, R.; Weathers, W. 1999. Atmospheric nitrogen deposition at a conifer forest: response of free amino acids in Engelmann spruce needles. Environmental Pollution. 105: 79-89.

He, Hong S.; Mladenoff, David J. 1999. Spatially explicit and stochastic simulation of forest-landscape fire disturbance and succession. Ecology. 80(1): 81-99.

He, Hong S.; Mladenoff, David J. The effects of seed dispersal on the simulation of long-term forest landscape change. Ecosystems. 2: 308-319.

He, Hong S.; Mladenoff, David J.; Boeder, Joel. 1999. An object-oriented forest landscape model and its representation of tree species. Ecological Modelling. 119: 1-19.

He, Hong S.; Mladenoff, David J.; Crow, Thomas R. 1999. Linking an ecosystem model and a landscape model to study forest species response to climate warming. Ecological Modelling. 113: 213-233.

Host, G.E.; Isebrands, J.G. 1997. Modeling the effects of climatic extremes on early growth of poplar under short rotation intensive culture. In: Gen. Tech. Rep. NC-196. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 7.

Kolb, T.E.; Fredericksen, T.S.; Steiner, K.C.; Skelly, J.M. 1997. Issues in scaling tree size and age responses to ozone: a review. Environmental Pollution. 98(2): 195-208.

Lawrence, Gregory B.; David, Mark B.; Shortle, Walter C.; Bailey, Scott W.; Lovett, G. M. 1999. Mechanisms of base-cation depletion by acid deposition in forest soils in the northeastern U.S. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 75-87.

McHale, Patrick J.; Mitchell, Myron J.; Bowles, Francis P. 1998. Soil warming in a northern hardwood forest: trace gas fluxes and leaf litter decomposition. Canadian Journal of Forest Research. 28: 1365-1372.

Miller, Eric K.; Friedland, Andrew J. 1999. Local climate influences on precipitation, cloud water, and dry deposition to an Adirondack subalpine forest: insights from observations 1986-1996. Journal of Environmental Quality. 28(1): 270-277.

Norton, Stephen B.; Fernandez, Ivan J., eds. 1999. The Bear Brook Watershed in Maine: a paired watershed experiment: the first decade (1987-1997). Dordrecht, Netherlands: Kluwer Academic Publishers: 250.

Skelly, J.M.; Fredericksen, T.S.; Savage, J.E.; Snyder, K.R. 1996. Vertical gradients of ozone and carbon dioxide within a deciduous forest in central Pennsylvania. Environmental Pollution. 94(2): 235-240.

Strand, Marc; Herms, Daniel A.; Ayres, Matthew P.; Kubiske, Mark E.; Kaufman, Michael G.; Walker, Edward D. 1999. Effects of atmospheric CO2, light availability and tree species on the quality of leaf detritus as a resource for treehole mosquitoes. OIKOS. 84: 277-283.

Yin, X. 1999. Atmospheric water vapor pressure over land surfaces: a generic algorithm with data input limited to air temperature, precipitation and geographic location. Theoretical and Applied Climatology. 63: 183-194.

Yin, Xiwei. 1998. Temporally-aggregated atmospheric optical properties as a function of common climatic information: systems development and application. Meteorology and Atmospheric Physics. 68: 99-113.

4455 Global Change Research Program NE-4455

Problem 1 Global Change Research

FY1999 Research Attainment

Publications

Attainment

The Northern Global Change Program focuses research on the effects of global change on the health and productivity of forested lands. The program has identified these major research priorities for the Northeast: Forest-atmosphere interactions, physiological response to atmospheric change and multiple stress, nutrient cycling and hydrologic response to acidic deposition, ecosystem process modeling, and regional and national analysis for management and policy.

The Program estimated how much carbon U.S. forest ecosystems can sequester and completed an analysis of the forestry implications of the Kyoto Protocol to limit greenhouse gases. Our U.S. forest carbon budget is used by USDA, EPA, DOE, Dept. of State, Council of Economic Advisors, forest industry, and others in developing a U.S. policy position. We are refining the analysis to use the latest national RPA database, including an analysis on the uncertainty of the carbon budget models as well as improving net primary productivity and biomass estimates using the FIA database.

Other carbon related research includes the science co-leadership role in the Ameriflux national network of flux towers to measure net ecosystem carbon exchange and forest atmosphere interaction.

We support CO2 and ozone research at the Free Air Carbon dioxide Exposure (FACE) facility in Rhinelander, Wisconsin. This is the largest ecosystem-scale fumigation experiment in the world, emphasizing ecosystem level responses to the multiple stress interaction of elevated CO2 and ozone to northern hardwood tree species.

We have applied regional ecosystem models to the Mid-Atlantic/Chesapeake Bay Watershed. Model output has shown that twice the current N deposition may result in much higher nitrate export in sensitive regions, which may impact policy decisions in the region.

We are participating in an interagency analyisis of environmental trends in the Delaware River Basin to implement state-of-the-art monitoring and ecosystem level research for this region.

In collaboration with the Southern Global Change Program, we are establishing a modeling framework and database standards for an East-Wide Assessment of forest productivity and health under global change and economic scenarios.

Problem 2 Global Change Research (Continued)

FY1999 Research Attainment

Publications

Research Unit

Amthor, Jeffrey S. 1999. Rising CO2 and forest water use: long-term data from Hubbard Brook Experimental Forest, New Hampshire. In: Adams, D. Briane, ed. Potential consequences of climate variability and change to water resources of the United States: AWRA symposium proceedings; 1999 MAY 10-12; Herndon, VA. Herndon, VA: American Water Resources Association: 399-402.

Hornbeck, J.W.; Bailey, S.W.; Buso, D.C.; Shanley, J.B. 1999. Streamwater chemistry: a useful tool for forest managers. In: Olsen, Darren S.; Potyondy, John P., eds. Wildland hydrology: AWRA symposium proceedings; 1999 JUNE 30-JULY 2; Bozeman, MT. TPS-99-3. Herndon, VA: American Water Resources Association: 361-367.

Iverson, Louis R.; Prasad, Anantha M. 1998. Predicting abundance of 80 tree species following climate change in the eastern United States. Ecological Monographs. 68(4): 465-485.

Iverson, Louis R.; Prasad, Anantha; Schwartz, Mark W. 1999. Modeling potential future individual tree-species distributions in the eastern United States under a climate change scenario: a case study with Pinus virginiana. Ecological Modeling. 115: 77-93.

Rebbeck, J.; Scherzer, A.J. 1999. Ozone and enriched carbon dioxide effects on the growth of eastern white pine seedling after 5 years. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine; 181. Abstract.

Scherzer, A.J.; Rebbeck, J.; Boerner, R.E.J. 1998. Foliar nitrogen dynamics and decomposition of yellow-poplar and eastern white pine during four seasons of exposure to elevated ozone and carbon dioxide. Forest Ecology and Management. 109: 355-366.

Schier, G.A.; McQuattie, C.J. 1999. Response of sugar maple seedlings to manganese. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 188. Abstract.

Schier, George A.; McQuattie, Carolyn J. 1999. Effect of nitrogen source on aluminum toxicity in nonmycorrhizal and ectomycorrhizal pitch pine seedling. Journal of Plant Nutrition. 22(6): 951-965.

Smith, James E.; Heath, Linda S. 1998. Multidisciplinary views in modeling response to climate change: a workshop summary. Gen. Tech. Rep. NE-251. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 18.

Wargo, Philip M. 1999. Integrating the role of stressors through carbohydrate dynamics. In: Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren. PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 107-112.

Problem 2 Global Change Research (Continued)

FY1999 Research Attainment

Publications

Cooperative

Bytnerowicz, A.; Padgett, P.; Percy, K.; Kyrwult, M.; Riechers, G.; Hom, J. 1999. Direct effects of nitric acid on forest trees. In: Miller, Paul R.; McBride, Joe R., comps., eds. Oxidant air pollution impacts in the montane forests of southern California. Ecol. Stud. 134. New York, NY: Springer-Verlag: 270-287.

Dickson, R E.; Coleman, M.D.; Riemenschneider, D.E.; Isebrands, J.G.; Hogan, G.D.; Karnosky, D.F. 1998. Growth of five hybrid poplar genotypes exposed to interacting elevated CO2 and O3. Canadian Journal of Forest Research. 28: 1706-1716.

Heilman, Warren E. 1998. Short-term precipitation variability patterns in the north central and northeastern U.S. and their relation to forest ecosystems. In: 23rd conference on agricultural & forest meteorology, 13th conference on biometeorology and aerobiology, and 2nd urban environment symposium; 1998 NOVEMBER 2-6; Albuquerque, NM. Boston, MA: American Meteorological Society: 357-360.

Heilman, Warren E.; Potter, Brian E.; Zerbe, John I. 1998. Regional climate change in the southern United States: the implications for wildfire occurrence. In: Mickler R.; Fox S., comps., eds. The productivity & sustainability of southern forest ecosystems in a changing environment. New York, NY: Springer Verlag: 683-699.

Hornbeck, James W.; Kochenderfer, James N.1998. Growth trends and management implications for West Virginia's red spruce forests. Northern Journal of Applied Forestry. 15(4): 197-202.

Potter, Brian E.; Zasada, John C. 1999. Biomass, thermal inertia, and radiative freeze occurrence in leafless forests. Canadian Journal of Forest Research. 29: 213-221.

Extramural

Evans, Celia A.; Miller, Eric K.; Friedland, Andrew J. 1998. Nitrogen mineralization associated with birch and fir under different soil moisture regimes. Canadian Journal of Forest Research. 28: 1890-1898.

Friedland, Andrew J.; Miller, Eric K. 1999. Major-element cycling in a high-elevation Adirondack forest: patterns and changes, 1986-1996. Ecological Applications. 9(3): 958-967.

He, Hong S.; Mladenoff, David J.; Radeloff, Volker C.; Crow, Thomas R. 1998. Integration of GIS data and classified satellite imagery for regional forest assessment. Ecological Applications. 8(4): 1072-1083.

Lawrence, Gregory B.; Huntington, T.G. 1999. Soil-calcium depletion linked to acid rain and forest growth in the eastern United States. In: WRIR 98-4267. [Place of publication unknown]: U.S. Department of the Interior, U.S. Geological Survey: 12.

LeBlanc, David C. 1998. Interactive effects of acidic deposition, drought, and insect attack on oak populations in the midwestern United States. Canadian Journal of Forest Research. 28: 1184-1197.

Livingston, W.H.; Greenwood, M.S.; Day, M.E.; White, A.S.; Brissette, J.C. 1999. Factors influencing growth and survival of jack pine (Pinus banksiana) and pitch pine (P. rigida) in overlapping ecological niches at their respective range limits. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millenium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 144. Abstract.

Yin, Xiwei. 1998. The albedo of vegetated land surfaces: systems analysis and mathematical modeling. Theoretical and Applied Climatology. 60: 121-140.

4501 Role of Forest Insect Biology and Biocontrol in Maintaining Forest Health
Shields, Kathleen S, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Improve understanding of biology and ecology of native and exotic forest insects	440	2.8	6	1	1
2.	Develop biologically based technologies to manage forest insect pests	380	1.2	4	5	2
3.	Develop quantitative methods for pest risk assessment of insect pests	180	1	2	2	0

4501 Role of Forest Insect Biology and Biocontrol in Maintaining Forest Health NE-4501

Problem 1 Improve understanding of biology and ecology of native and exotic forest insects

FY1999 Research Attainment

Publications

Research Unit

Keena, Melody A. 1998. Comparison of survival and development of Lymantria monacha L. (Lepidoptera: Lymantriidae) on a broad range of North American plant hosts. In: Joint annual meeting of the Entomological Society of America and the American Phytopathological Society; 1998 NOVEMBER 8-12; Las Vegas, NV. Lanham, MD: Entomological Society of America: 83. Poster.

Keena, Melody A. 1999. Comparison of survival and development of Lymantria monacha (Lepidoptera: Lymantriidae) on a broad range of North American plant hosts. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 36. Abstract.

Keena, Melody A. 1999. Comparison of survival and development of Lymantria monacha L. (Lepidoptera: Lymantriidae) on a broad range of North American plants. In: Greater New England symposium on the ecology of invasive species; 1999 FEBRUARY 27; New Haven, CT. New Haven, CT: Yale University School of Forestry and Environmental Studies. Poster.

Sanchez, Vicente. 1999. Genetic diversity in populations of a moth displaying a clinal frequency distribution of flight capable females. In: 9th annual New England molecular biologists meeting; 1999 OCTOBER 31; New York University; New York, NY. New York, NY: New England Evolutionary Biologists Association. Poster.

Sanchez, Vicente. 1999. Variability in allozyme loci and flight capability in laboratory strains of Lymantria dispar (Lepidoptera: Lymantriidae). In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W.; eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U..S. Department of Agriculture, Forest Service, Northeastern Research Station: 52. Abstract.

Willis, Raymond B.; Allen, Philip R. 1999. Measurement of amorphous ferric phosphate to assess iron bioavailability in diets and diet ingredients. Analyst. 124: 425-430.

Cooperative

Keena, Melody; Shields, Kathleen; Torsello, Mary. Nun moth: potential new pest. In: Pest Alert NA-PR-95-98. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry: 2.

Extramural

Zolubas, Paulius; Gedminas, Arturas; Shields, Kathleen. 1999. Gypsy moth oviposition site finding behavior on surfaces with different slope. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 79. Abstract.

Attainment

Research was completed to improve understanding of the biology and ecology of a number of non-native forest insect pests. Techniques were developed to identify all stages of nun moth, Lymantria monacha, and to distinguish this exotic species from the closely related, established gypsy moth, L. dispar. Research on host plant preference of nun moth determined that several species of North American conifers and broadleaf trees are suitable for nun moth development and survival. This indicates that nun moth has a high potential for establishment on native tree species in North America. Research was conducted to identify and analyze large scale genetic differences in North American, European, and Asian gypsy moth. Results indicate that flight indices of female gypsy moths are associated with genetic diversity of the populations. A new technique was developed to assess the bioavailability of iron in insect diets and diet ingredients. Iron is essential for normal growth and development of many insects grown in laboratory culture.

4501 Role of Forest Insect Biology and Biocontrol in Maintaining Forest Health NE-4501

Problem 2 Develop biologically based technologies to manage forest insect pests

FY1999 Research Attainment

Publications

Research Unit

Montgomery, M.E.; Wu, J. 1999. Non-native pests of forests in China. In: The Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America; 27. Abstract.

Montgomery, Michael E. 1999. Biological controls for the hemlock woolly adelgid. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 42. Abstract.

Montgomery, Michael E.; Lazell, James. 1999. Why are eastern North American forests so susceptible to pests from Asia? Greater New England symposium on the ecology of invasive species; 1999 FEBRUARY 27; New Haven, CT. New Haven, CT: Yale University School of Forestry and Environmental Studies: 25. Abstract.

Shields, Kathleen S.; Bonneau, Laurent R.; Mikus, David R. 1998. Satellite imagery used to classify health of eastern hemlock impacted by hemlock woolly adelgid. In: Joint annual meeting of the Entomological Society of America and American Phytopathological Society; 1998 NOVEMBER 8-12; Las Vegas, NV. Lanham, MD: Entomological Society of America: 37. Poster.

Cooperative

Baranchikov, Y.N.; Smith, H.R.; Wallner, W.E.; Timchenko, G.A. 1998. Small mammals as a mortality factor in European and Asian populations of gypsy moth. In: Biological and integrated forest protection; 1998 SEPTEMBER 7-11; Pushkino, Russia. Pushkino, Russia: Federal Forest Service of Russia: 7-8. Abstract. (In Russian).

Lu, Wenhua; Montgomery, Michael E. 1999. Comparative biology of three Scymnus lady beetles (Coleoptera: Coccinellidae): predators of Adelges tsugae (Homoptera: Adelgidae). In: Sustainable management of hemlock ecosystems in eastern North America; 1999 JUNE 22-24; Durham, NH. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. Poster.

Extramural

Bonneau, Laurent R.; Civco, Daniel L.; Shields, Kathleen. 1999. Classification and spatial analysis of eastern hemlock using remote sensing and GIS. In: Greater New England symposium on the ecology of invasive species; 1999 FEBRUARY 27; New Haven, CT. New Haven, CT: Yale University School of Forestry and Environmental Studies: 9. Abstract.

Bonneau, Laurent R.; Civco, Daniel L.; Shields, Kathleen. 1999. Use of satellite imagery to identify changes in hemlock health over time. In: Greater New England symposium on the ecology of invasive species; 1999 FEBRUARY 27; New Haven, CT. New Haven, CT: Yale University School of Forestry and Envirionmental Studies: 9-10. Poster.

Bonneau, Laurent R.; Shields, Kathleen S.; Civco, Daniel L.; Mikus, David R. 1999. Classification and spatial analysis of eastern hemlock health using remote sensing and GIS. In: Symposium on sustainable management of hemlock ecosystems in eastern North America; 1999 JUNE 22-24; Durham, NH. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. Poster.

Bonneau, Laurent R.; Shields, Kathleen S.; Mikus, David R. 1999. Satellite imagery used to classify health of eastern hemlock impacted by hemlock woolly adelgid. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 21. Abstract.

Bonneau, Laurent R.; Shields, Kathleen S.; Mikus, David R. 1999. Satellite imagery used to classify health of eastern hemlock impacted by hemlock woolly adelgid. In: Symposium on sustainable management of hemlock ecosystems in eastern North America; 1999 JUNE 22-24; Durham, NH. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. Poster.

4501 Role of Forest Insect Biology and Biocontrol in Maintaining Forest Health NE-4501

Problem 2 Develop biologically based technologies to manage forest insect pests

FY1999 Research Attainment

Publications

Attainment

Technologies are being developed to reduce the impact of non-native forest insects. One such pest is the hemlock woolly adelgid, which is causing extensive mortality of hemlock in the eastern U.S. The adelgid is native to Asia and exploration in China has resulted in the discovery of several natural enemies of the hemlock woolly adelgid, most of which are new to science. Three species of ladybird beetles have been imported from China and evaluated as potential biological controls. One species, Scymnus sinuanodulus, shows particular promise. Remote sensing and GIS technologies have been used to classify the health of eastern hemlock that have been impacted by hemlock woolly adelgid, and to monitor changes in hemlock health over time. Research on another non-native pest, the gypsy moth, determined that the genetic (allozyme) variability of one of its parasites was low. This suggests that the genotypes of the founding colonies were restricted, which may reduce the effectiveness of the parasite as a biological control. A theoretical understanding is being developed of the historical and ecological factors influencing the exchange of pests between Asia and North America.

4501 Role of Forest Insect Biology and Biocontrol in Maintaining Forest Health NE-4501

Problem 3 Develop quantitative methods for pest risk assessment of insect pests

FY1999 Research Attainment

Publications

Research Unit

Wallner, William E. 1999. Assessing exotic threats to international forest resources. In: Downey, Judith; Roberts, Fiona; Eddy, Grahame; Juranek, Karla, comps. National stakeholder timber pest conference proceedings; 1999 APRIL 20-22; Canberra, Australia. Canberra, Australia: Australian Quarantine and Inspection Service, Timber Pest Coordination Unit: 53-70.

Wallner, William E. 1999. Invasive pests: threats to forest biodiversity, management, and commerce. In: Proceedings, 49th annual western forest insect work conference; 1998 MARCH 2-5; Jackson, WY. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 59.

Extramural

National Plant Board. 1999. Safeguarding American plant resources. A stakeholder review of the APHIS-PPO safeguarding system. Summary of issues, findings and recommendations. [Place of publication unknown]: [Publisher name unknown]: 113. [William E. Wallner, work unit scientist, was member of Pest Exclusion Team and contributed to report.]

National Plant Board. 1999. Safeguarding American plant resources. A stakeholder review of the APHIS-PPO safeguarding system. [Place of publication unknown]: [Publisher name unknown]: 35. [William E. Wallner, work unit scientist, was member of Pest Exclusion Team and contributed to report.]

Attainment

Assessing the risk of introducing exotic forest pests was completed for importation of unprocessed lumber from Mexico and South America. This procedure is being considered by the Australian Quarantine Inspection Service in developing their timber/pest exclusion program. It also is being employed for the national/international risk assessment for solid wood packing materials. A unit scientist served as an invited member of the National Plant Board Task Force to evaluate APHIS-PPQ effectiveness in safeguarding American plant resources. Following interviews with APHIS staff and observations of facilities and procedures at numerous port/border crossings a series of recommendations was made. These recommendations were intended to redesign APHIS's managerial and operational procedures in order to improve its effectiveness in excluding, detecting, or eradicating exotic pests threats to American plant resources.

4502 Pathology and Microbial Control of Insects That Impact the Health of Eastern Forests
McManus, Michael L, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Develop the technology to optimize performance of Bt against native and exotic defoliating insects	150	.4	0	1	0
2. Optimize production and performance of GYPCHEK against the gypsy moth and understand NPV epizootiology	544	1.7	7	0	0
3. Accelerate the use of entomopathogens against invasive and newly-established forest pests	90	.9	1	2	1
M1. Determine the effect of microbial pesticides and non-indigenous pathogens against non-target organisms	0	0	0	0	0

4502 Pathology and Microbial Control of Insects That Impact the Health of Eastern Forests NE-4502

Problem 1 Develop the technology to optimize performance of Bt against native and exotic defoliating insects

FY1999 Research Attainment

Publications

Cooperative

Liebhold, Andrew; McManus, Michael. 1999. The evolving use of insecticides in gypsy moth management. Journal of Forestry. 97(3): 20-23.

Extramural

Turcani, Marek. 1999. The role of gypsy moth predators in population dynamics in relation to its population density in Slovakia-first experience. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W.; eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 71-73. Abstract.

Attainment

We continue to bioassay new Bt strains and formulations as well as individual CRY toxins against the gypsy moth, browntail moth (Euproctis) and other select species of Lymantriidae. These potential products are provided to us through our university and industry cooperators. As an important prerequisite to these studies, we will continue to maintain a colony of the NJSS strain of Lymantria dispar at the Insect Rearing Facility (IRF) located at the Hamden, CT laboratory.

4502 Pathology and Microbial Control of Insects That Impact the Health of Eastern Forests NE-4502

Problem 2 Optimize production and performance of GYPCHEK against the gypsy moth and understand NPV epizootiology

FY1999 Research Attainment

Publications

Research Unit

D'Amico, Vincent; Elkinton, Joseph S.; Podgwaite, John D.; Slavicek, James M.; McManus, Michael L.; Burand, John P. 1999. A field release of genetically engineered gypsy moth (Lymantria dispar L.) nuclear polyhedrosis virus (LdNPV). Journal of Invertebrate Pathology. 73: 260-268.

Malakar, Raksha; Elkinton, Joseph S.; Carroll, Steven D.; D'Amlco, Vince. 1999. Interactions between two gypsy moth (Lepidoptera: Lymantriidae) pathogens: Nucleo polyhedrosis virus and Entromophaga maimaiga (Zygomycetes: Entomophthorales): field studies and a simulation model. Biological Control. 16: 189-198.

Miller, David R.; Stoughton, Thomas E.; Thorpe, Kevin; Podgwaite, John; Reardon, Richard; McManus, Michael. 1999. Lidar measurements of pesticide spray drift in different atmospheric stabilities. In: American Meteorological Society 23rd conference on agricultural and forest meteorology; American Meteorological Society. [Place of publication unknown]: 375-278.

Podgwaite, John D. 1998. Gypchek: regulatory and operational status. In: Proceedings of the 1997 annual gypsy moth review; Charleston, WV. [Place of publication unknown]: [Publisher name unknown]: 81.

Podgwaite, John D. 1999. Gypchek: biological insecticide for the gypsy moth. Journal of Forestry. 97(3): 16-19.

Thorpe, K.W.; Podgwaite, J.D.; Slavicek, J.M.; Webb, R.E.; Fuester, R.F.; Pfeiffer, R.A.; Valenti, M.A.; Taylor, P.B. 1999. Field-based estimates of dose responses of three gypsy moth virus strains with and without the virus enhancer, Blankophor BBH. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 68-70. Abstract.

Webb, R.E.; Thorpe, K.W.; Podgwaite, J.D.; Reardon, R.C.; White, G.B.; Talley, S.E. 1998. Field evaluation of an improved formulation of Gypchek (a nuclear polyhedrosis virus product) against the gypsy moth (Lepidoptera: Lymantriidae). Journal of Entomological Science. 34(1): 72-83.

Attainment

Gypchek the gypsy moth specific viral pesticide continues to be produced by project personnel in cooperation with the APHIS Methods Development Center on Cape Cod MA. Several thousand acre equivalents were produced in FY-99 and over 9000 acres of environmentally sensitive habitats in North Carolina, Wisconsin and Michigan were treated in conjunction with state and federal cooperative suppression and eradication programs. A collaborative study with the University of Massachusetts and NE-4509 detailed the first release and recovery of a genetically engineered insect virus in a forested ecosystem in the United States and was a significant first step toward the development of genetically engineered viral recombinants for gypsy moth control. Gypsy moth nucleopolyhedrosis virus (NPV) epizootiology continues to be studied in an oak plantation established by project personnel. Important relationships between when and where first instar larvae die and the subsequent levels of infection in gypsy moth populations were uncovered and will be useful in modeling NPV dynamics.

Also, it was determined that gypsy moth is refractible to the immunosuppressive effects that are imparted to other insects by Cotesia vectored polydnaviruses (PdV). Cotesia melanoscela PdV does not augment mortality from naturally occurring NPV and plays no direct role in NPV dynamics. Collaborative spray drift studies with ARS, University of Connecticut, and other Forest Service scientists, and field experiments on Gypchek formulation and application, have been completed and will be useful in planning operational spray programs, particularly in sensitive habitats.

Results of other collaborative studies with ARS scientists indicated that the stilbene Blankophor BBH, is a strong enhancer of NPV virulence and, pending consideration of safety issues, will be considered as an additive in Gypchek formulations.

Results from the above mentioned studies have been communicated either through presentations before scientific societies or through published manuscripts.

4502 Pathology and Microbial Control of Insects That Impact the Health of Esatern Forests NE-4502

Problem 3 Accelerate the use of entomopathogens against invasive and newly-established forest pests

FY1999 Research Attainment

Publications

Research Unit

Maddox, J.V.; Baker, M.D.; Jeffords, M.R.; Kuras, M.; Linde, A.; McManus, M.L. 1999. Nosema portugal, N.S.P., isolated from gypsy moth (Lymantria dispar L.) collected in Portugal. Journal of Invertebrate Pathology. 73: 1-14.

Cooperative

Bauer, Leah S.; Miller, Deborah L.; Maddox, Joseph S.; McManus, Michael L. 1998. Interactions between a Nosema sp. (Microspora: Nosematidae) and nuclear polyhedrosis virus infecting the gypsy moth, Lymantria dispar (Lepidoptera: Lymantriidae). Journal of Invertebrate Pathology. 72: 147-153.

Hajek, A.E.; Bauer, L.S.; McManus, M.L.; Wheeler, M.M. 1998. Distribution of resting spores of the Lymantria dispar pathogen Entomophaga maimaiga in soil and on bark. BioControl. 43: 189-200.

Extramural

Hoch, Gernot; Schopf, Axel; Maddox, J. V. 1999. Effects of microsporidian infection of gypsy moth larvae on the host-parasitoid system, Lymantria dispar (Lep.: Lymantriidae) Glyptapanteles liparidis (Hymo: Braconidae). In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agricultural interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 33. Abstract.

Solter, Leellen F.; Maddox, Joseph V. 1998. Timing of an early sporulation sequence of microsporidia in the genus vairimorpha (Microsporidia: Burenellidae). Journal of Invertebrate Pathology. 72: 323-329.

Attainment

A new species of entomopathogen (microsporidia) isolated from gypsy moth populations in Europe was described and published. Studies were completed and published that describe the interaction of this pathogen with the gypsy moth nucleopolyhedrosis virus that is indigenous to gypsy moth populations throughout its distribution. Valuable information was obtained and published about the distribution of resting spores of entomophaga maimaiga in soil and bark. This entomopathogen has had a significant impact on the dynamics of gypsy moth populations in the eastern U.S. since its discovery in 1989. Studies were initiated to determine the susceptibility of the Asian longhorned beetle (ALB), Anoplophora glabripennis, to commercial and experimental formulations of Bacillus thuringiensis (Bt) and its associated toxins. Novodor® (Abbott Laboratories) was tested in per os assays against ALB larvae and adults, while several experimental cry toxins from Bt were tested using voltage clamp instrumentation, a procedure that relates change in gut membrane potential to toxin susceptibility. Preliminary assays were inconclusive when both ALB larvae and adults were fed Novodor,® but voltage clamp experiments demonstrated the susceptibility of larvae to cry toxins. Additional experiments are underway to survey the microflora associated with ALB, the goal being to discover pathogenic microorganisms, i.e., bacteria and viruses, that have potential for development as microbial control products that can be used against ALB.

4502 Pathology and Microbial Control of Insects That Impact the Health of Eastern Forests NE-4502

Problem M1 Determine the effect of microbial pesticides and non-indigenous pathogens against non-target organisms

FY1999 Research Attainment

Publications

Attainment No progress to report this fiscal year.

4505 Disturbance of Eastern Forest Ecosystems by Stressor/Host/Pathogen Interactions
Wargo, Philip M, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Relationship of stessor/host/pathogen and site interactions to forest maturation, disturbance, and gap formation is poorly understood	482	1.9	7	4	1
2.	Too few dependable early indicators of forest tree vulnerability to disturbance from stressor/host/pathogen interactions	485	2.6	8	9	0
3.	Tools are inadequate to predict, prevent, and mitigate disturbances that threaten forest sustainability and management objectives	105	.5	3	0	0

4505 Disturbance of Eastern Forest Ecosystems by Stressor/Host/Pathogen Interactions NE-4505

Problem 1 Relationship of stessor/host/pathogen and site interactions to forest maturation, disturbance, and gap formation is poorly understood

FY1999 Research Attainment

Publications

Research Unit

Houston, David R. 1999. Beech bark disease: the result of an invasive causal complex. Greater New England symposium on the ecology of invasive species; 1999 FEBRUARY 27; New Haven, CT. New Haven, CT: Yale School of Forestry & Environmental Studies: 16-17. Abstract.

Houston, David R. 1999. History of sugar maple decline. In: Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren. PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 19-26.

Mahoney, Eileen M.; Milgroom, Michael G.; Sinclair, Wayne A.; Houston, David B. 1999. Origin, genetic diversity, and population structure of Nectria coccinea var. faginata in North America. Mycologia. 91(4): 583-592. [Paper presented from data of deceased FS employee - Eileen Mahoney - by her friends and colleagues.]

Smith, K.T.; Sutherland, E.K. 1999. Fire scar structure in oak. In: Ecological Society of America 84th annual meeting: legacies, landscapes and limits: bridging borders; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 308. Poster.

Smith, Kevin T.; Sutherland, Elaine Kennedy.1999. Fire-scar formation and compartmentalization in oak. Canadian Journal of Forest Research. 29(2): 166-171.

Wargo, P.M.; Fagan, J.C. 1999. Armillaria attack of hemlock woolly adelgid infested hemlock. Symposium on sustainable management of hemlock ecosystems in eastern North America; 1999 JUNE 22-24; Durham, NH. Durham, University of New Hampsire. Poster.

Wargo, Philip M. 1999. Integrating the role of stressors through carbohydrate dynamics. In: Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren. PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 107-112.

Cooperative

Lawrence, Gregory B.; David, Mark B.; Shortle, Walter C.; Bailey, Scott W.; Lovett, Gary M. 1999. Mechanisms of base-cation depletion in forest soils of the northeastern U.S. In: Horsley, Stephen B.; Long, Robert P. eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 75-87.

Extramural

Burrill, E.A.; Worrall, J.J.; Wargo, P.M.; Stehman, S.V. 1999. Effects of defoliation and cutting in eastern oak forests on Armillaria spp. and a competitor, Megacollybia platyphylla. Canadian Journal of Forest Research. 29: 347-355.

Connolly, Jon H.; Shortle, Walter C.; Jellison, Jody. 1999. Translocation and incorporation of strontium carbonate derived strontium into calcium oxalate crystals by the wood decay fungus Resinicium bicolor. Canadian Journal of Botany. 77: 179-187.

David, M.B.; Cupples, A.M.; Lawrence, G.B.; Shi, G.; Vogt, K.A.; Wargo, P.M. 1998. Effect of chronic nitrogen additions on soil nitrogen fractions in red spruce stands. Water, Air, and Soil Pollution. 105: 183-192.

Vogt, Kristina A.; Vogt, Daniel J.; Boon, Paul; Fanzeres, Anna; Wargo, Philip M.; Palmiotto, Peter A. 1999. A non-value based framework for assessing ecosystem integrity. In: Meurisse, Robert T.; Ypsilantis, William G.; Seybold, Cathy, eds. Proceedings: Pacific Northwest forest & rangeland soil organism symposium; 1998 MARCH 17-19; Corvallis, OR. Gen. Tech. Rep. PNW-GTR-461. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 3-20.

4505 Disturbance of Eastern Forest Ecosystems by Stressor/Host/Pathogen Interactions NE-4505

Problem 1 Relationship of stessor/host/pathogen and site interactions to forest maturation, disturbance, and gap formation is poorly understood

FY1999 Research Attainment

Publications

Attainment

Established six study areas in New England to assess damage to northern hardwoods due to ice storm injury in 1998. Initial results show that internal damage (discoloration and decay) was highly localized and spreading. Growth effects will require more observations over time.

Studies on Armillaria root disease in declining sugar maple stands in Pennsylvania indicate that rhizomorph abundance of the fungus is increased by additions of lime to the plots and by the abundance of sugar maple food bases. As lime also had a positive effect on tree vigor, the fungus was unable to infect the healthier trees in spite of the increase in rhizomorphs.

Oak tree survival after fire depended on effective compartmentalization of injury and infection.

New studies on microbial biomass in forest soils with low and high Ca contents were initiated. Biomass will be related to the available Ca in the soil as well as Ca/Al ratio.

New studies were initiated on carbohydrate production in sugar maple stands with different levels of available Mg in the soil These studies will help elucidate factors affecting vulnerability of sugar maple to decline after stress.

4505 Disturbance of Eastern Forest Ecosystems by Stressor/Host/Pathogen Interactions NE-4505

Problem 2 Too few dependable early indicators of forest tree vulnerability to disturbance from stressor/host/pathogen interactions

FY1999 Research Attainment

Publications

Research Unit

Minocha, R.; Aber, J.; Long, S.; Magill, A.H.; McDowell, W. 1999. Effects of chronic nitrogen additions, at the Harvard Forest, MA, on polyamine metabolism and inorganic ion uptake of the foliage and soil and soil solution chemistry of pine and hardwoods stands. Women in science; 1999 MARCH 25; Durham, NH. Durham, NH: University of New Hampshire. Poster.

Minocha, R.; Long, S. 1999. Polyamines as markers of environmental stress in forest trees. 1999 AUGUST 22-27; Oxford, UK. Oxford, UK: Oxford University, Queens College, Gordon Research Conference. Poster.

Minocha, R.; Long, S.; Maki, H.; Minocha, S. C. 1999. Assays for the activities of polyamine biosynthetic enzymes using intact tissues; 1999 AUGUST 22-27; Oxford , UK. Oxford, UK: Oxford University, Queens College, Gordon Research Conference. Poster.

Minocha, Rakesh. 1999. Markers of environmental stress in forest trees. In: Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 106. Abstract.

Minocha, Rakesh; Long, Stephanie; Maki, Hisae; Minocha, Subhash C. 1999. Assays for the activities of polyamine biosynthetic enzymes using intact tissues. Plant Physiology and Biochemistry. 37: 1-7.

Minocha, Rakesh; Smith, Dale R.; Reeves, Cathie; Steele, Kevin D.; Minocha, Subhash C. 1999. Polyamine levels during the development of zygotic and somatic embryos of Pinus radiata. Physiologia Plantarum. 105: 155-164.

Shortle, Walter C. 1999. Indicators of acid deposition effects on trees. In: Sharpe, William E.; Dronan, Joy R. eds. Proceedings of the 1998 Pennsylvania acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 261-262. Abstract.

Smith, K. T.; Cufar, K.; Levanic, T. 1999. Temporal stability and dendroclimatology, 2nd Slovenian symposium on plant pathology. Poster.

Cooperative

Nowak, David; Corder, Kelly; Hakkarinen, Chuck; Kraft, Michael; Miller, David; Wargo, Philip. 1998. Ozone and ecological effects. In: Smardon, Richard; Keith, Sara; Hansen, Beverly, eds. Adirondacks and beyond: understanding air quality and ecosystem relationships: a conference to explore science and policy linkages; 1997 NOVEMBER 12-13; Saratoga Springs, NY. Syracuse, NY: SUNY College of Environmental Science and Forestry, Randolph G. Pack Institute: 40-41.

4505 Disturbance of Eastern Forest Ecosystems by Stressor/Host/Pathogen Interactions NE-4505

Problem 2 Too few dependable early indicators of forest tree vulnerability to disturbance from stressor/host/pathogen interactions

FY1999 Research Attainment

Publications

Extramural

Minocha, S.C.; Glasheen, B.; Bains, S.; Bhatnagar, P.; Walter, C.; Smith, D.; Long, S.; Minocha, R. 1999. Genetic manipulation of the metabolism of polyamines and it's effects on related pathways. Northeast section of the American Society of Plant Physiologists; 1999 APRIL 23-24; Durham, NH. Durham, NH: University of New Hampshire. Poster.

Minocha, S.C.; Glasheen, B.; Bains, S.; Bhatnagar, P.; Walter, C.; Smith, D.; Long, S.; Minocha, R. 1999. Genetic manipulation of the metabolism of polyamines and it's effects on related pathways; 1999 AUGUST 22-27; Oxford, UK. Oxford, UK: Oxford University, Queens College, Gordon Research Conference. Poster.

Minocha, S.C.; Glasheen, B.; Bains, S.; Bhatnagar, P.; Walter, C.; Smith, D.; Long, S.; Minocha, R. 1999. Genetic manipulations of the metabolism of polyamines and it's effects on related pathways; American Society of Plant Physiologists; 1999 JULY 24-28; Baltimore, MD. Baltimore, MD: American Society of Plant Physiologists. Poster.

Minocha, S.C.; Glasheen, B.; Bains, S.; Bhatnagar, P.; Walter, C; Smith, D.; Long, S.; Minocha, R. 1999. Genetic manipulation of the metabolism of polyamines and it's effects on related pathways; Women in science; 1999 MARCH 25; Durham, NH. Durham, NH: University of New Hampshire. Poster.

Minocha, Subhash C.; Glasheen, Bernadette M; Bains, Suneet K; Bhatnagar, Pratiksha; Walter, Christian; Smith, Dale R.; Long, Stephanie L; Minocha, Rakesh; Minocha, Subhash C. 1999. Genetic manipulation of the metabolism of polyamines and its effects on related pathways. American Society of Plant Physiologists annual meeting; 1999 JULY 24-28; Baltimore, MD. Baltimore, MD: American Society of Plant Physiologists: 74. Abstract.

Minocha, Subhash C.; Minocha, Rakesh. 1999. Genetic transformation in conifers. In: Jain, S.M.; Gupta, P.K. comps., eds. Somatic embryogenesis in woody plants, volume 5. Dordrecht, The Netherlands: Kluwer Academic Publishers: 291-312.

Oven, Primoz; Torelli, Niko; Shortle, Walter C. ; Zupancic, Martin. 1999. The formation of a ligno-suberised layer and necrophylacic periderm in beech bark (Fagus sylvatica L.). Flora. 194: 137-144.

Torelli, N.; Shortle, W. C.; Cufar, K.; Ferlin. F.; Smith, K. T. 1999. Detecting changes in tree health and productivity of silver fir in Slovenia. European Journal of Forest Pathology. 29: 189-197.

Attainment

Cambial electrical resistance, foliar polyamines, and starch content in sugar maple all reflected changes in tree vitality in response to application of lime. All three showed the beneficial effects of liming on tree growth and vigor. This represents the first report that treatments used to improve tree health decreased the polyamine level (a marker of tree stress) in the foliage.

Cooperative studies in Slovenia showed that cambial electrical resistance could be used to detect changes in wood-forming capacity in mature forest trees.

4505 Disturbance of Eastern Forest Ecosystems by Stressor/Host/Pathogen Interactions NE-4505

Problem 3 Tools are inadequate to predict, prevent, and mitigate disturbances that threaten forest sustainability and management objectives

FY1999 Research Attainment

Publications

Research Unit

Houston, David B. 1999. Conservation of beech--a matter of reclaiming lost values. In: Proccedings: Northeastern Forest Pest Council annual meeting 1998; 1998 MARCH 9-11; Fredericton, NB. [Publisher name unknown]: [Place of publication unknown]: 49-59.

Smith, Kevin T.; Shortle, Walter C. 1998. A first look at tree decay: an introduction to how injury and decay affect trees. NA-PR-02-98. Radnor, PA: U.S.Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry: 4.

Wargo, Philip M. 1999. Stress: from the branches to the roots and back again. Tree Care Industry. 10(6): 8-15.

Attainment

Demonstrated to a range of customers that loss of wood quality from ice injury in 1998 was highly localized and would spread at a rate slow enough to allow ample time to plan harvesting operations. Digital photography of external and internal defect were interpreted and distributed in leaflets and web pages, in cooperation with NA-State and Private Forestry and state extension and forestry groups.

Documented through digital photography and interpretation, the success of Crop Tree Selection practices at the Marsh-Billings-Rockefeller National Historic Park in Woodstock, VT, in cooperation with NA-State & Private Forestry and the National Park Service (DOI). The images were used to develop color booklets and CD's for users groups including senators and congressmen from VT.

4509 Development of Biologically Based Controls for Forest Insect Pests and Diseases Through Molecular Technologies
Slavicek, James M, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Fundamental development of biological agents and biorational approaches for insect control	667	2.9	20	0	0
2. Develop biological and biorational approaches for control of tree diseases	500	1	6	1	0
3. Use of biotechnology to generate solutions to problems supporting current research	25	.1	1	0	0

4509 Development of Biologically Based Controls for Forest Insect Pests and Diseases Through Molecular Technologies NE-4509

Problem 1 Fundamental development of biological agents and biorational approaches for insect control

FY1999 Research Attainment

Publications

Research Unit

Bills, Steven; Podila, Gopi K.; Hiremath, Shiv. 1999. Genetic engineering of an ectomycorrhizal fungus Laccaria bicolor for use as a biological control agent. Mycologial. 91(2): 237-242.

Bischoff, David S.; Slavicek, James M. 1999. Impact of deletion of the Lymantria dispar nucleopolyhedrovirus PEP gene on viral potency. Biological Control. 14: 51-59.

D'Amico, Vincent; Elkinton, Joseph S.; Podgwaite, John D.; Slavicek, James M.; McManus, Michael L.; Burand, John P. 1999. A field release of genetically engineered gypsy moth (Lymantria dispar L.) nuclear polyhedrosis virus (LdNPV). Journal of Invertebrate Pathology. 73: 260-268.

Garner, Karen J.; Valaitis, Algimantas P. 1999. Cloning of a putative CRy 1 Aa/Cry 1 Ab Bacillus thuringiensis toxin receptor from the gypsy moth and other invasive species. In: Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture. Forest Service. Northeastern Research Station: 26. Abstract.

Garner, Karen J; Hiremath, Shiv; Lehtoma, Kirsten; Valaitis, Algimantas P. 1999. Cloning and complete sequence characterization of two gypsy moth aminopeptidase-N cDNAs, including the receptor for Bacillus thuringiensis Cryl Ac toxin. Insect Biochemistry and Molecular Biology. 29: 527-535.

Kim, Sung-Jae; Hiremath, Shivananad T.; Podila, Gopi K. 1999. Cloning and identification of symbiosis-regulated genes from the ectomycorrhizal Laccaria bicolor. Mycological Research. 103(2): 168-172.

Kim, Sung-Jae; Zheng, Jun; Hiremath, Shivananad T.; Podila, Gopi K. 1998. Cloning and characterization of a symbiosis-related gene from an ectomycorrhizzal fungus Laccaria bicolor. Gene. 222: 203-212.

Kuzio, John; Pearson, Margot N.; Harwood, Steve H.; Funk, C. Joel; Evans, Jay T.; Slavicek, James M.; Rohrmann, George F. 1999. Sequence and analysis of the genome of a baculovirus pathogenic for Lymantria dispar. Virology. viro.1998.9469: 17-34.

Popham, H.J.R.; Bischoff, D.S.; Slavicek, J.M. 1999. Deletion of both enhancin genes in the lymantria dispar MNPV greatly reduces viral potency. In: American Society for Virology: 18th annual meeting; 1999 JULY 10-14; Amherst MA. [Place of publication unknown]: [Publisher name unknown]: 71. 68-70 Abstract.

Popham, H.J.R.; Bischoff, D.S.; Slavicek, J.M. 1999. Molecular characterization of a second enhancin gene homolog in the Lymantria dispar nuclear polyhedrosis. In: Society for Invertebrate Pathology 1999, 32nd annual meeting; 1999 AUGUST 22-27; Irvine, CA. [Place of publication unknown]: [Publisher name unknown]: 65. Abstract.

Popham, H.J.R.; Slavicek, J.M. 1999. Two enhancin homologs are required for virion occlusion in Ld M NPV. In: Society for Invertebrate Pathology 1999, 32nd annual meeting; 1999 AUGUST 22-27: Irvine, CA. [Place of publication unknown]: [Publisher name unknown]: 65. Abstract.

Slavicek, J.M.; Hayes-Plazolles, N.; Popham, H.J.R.; Kelly, M. 1999. Isolation of a Lymantria dispar nuclear polyhedrosis virus strain that exhibits stable polyhedra production during serial passage. In: Society for Invertebrate Pathology 1999, 32nd annual meeting, 1999 AUGUST 22-27; Irvine, CA. [Place of publication unknown]: [Publisher name unknown]: 70. Abstract.

Slavicek, J.M.; Kelly, M.E.; Mercer, M.; Hayes-Plazolles, N. 1999. A mutation in the LdMNPV polyhedral envelope protein gene region causes abnormal polyhedron formation. In: Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22: Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 58. Abstract.

4509 Development of Biologically Based Controls for Forest Insect Pests and Diseases Through Molecular Technologies NE-4509

Problem 1 Fundamental development of biological agents and biorational approaches for insect control

FY1999 Research Attainment

Publications

Research Unit

Slavicek, James M. Inventors; The United States of America as represented by the Secretary of Agriculture, assignee. 1998 DECEMBER 29. Method of isolating strains of the Lymantria dispar nuclear polyhedrosis virus. U.S. patent 5,853,982. Int. Cl1. C120#1/70; C12N 7/00; C12N 7/02. U.S. Cl 435/5; 435/235.1; 435/239.

Slavicek, James M.; Hayes-Plazolles, Nancy. Inventors; The United States of America as represented by the Secretary of Agriculture, Washington D.C., assignee. 1999 MARCH 16. Strain of gypsy moth virus with enhanced polyhedra and budded virus production. U.S. Patent 5,882,913, Int. C16. C12N 5/00; C12N 7/00. U.S. Cl.435/235.1; 435/325; 424/93.6.

Slavicek, James M.; Popham, Holly J.R.; Riegel, Christopher I. 1999. Deletion of the LdMNPV Ecdysteroid UDP-Glucosyl transferase gene enhances viral killing speed in the ultimate larval instar of infected Lymantria dispar. In: Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266, Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 59 Abstract.

Slavicek, James M.; Popham, Holly J.R.; Riegel, Christopher I.. Deletion of the Lymantria dispar multicapsid nucleopolyhedrovirus ecdysteroid UDP-glucosyl transferase gene enhances viral killing speed in the last instar of the gypsy moth. Biological Control. 16: 91-103.

Thorpe, K.W.; Podgwaite, J.D.; Slavicek, J.M.; Webb, R.E.; Fuester, R.F.; Pfeiffer, R.A.; Valenti, M.A.; Taylor, P.B. 1999. Field-based estimates of dose responses of three gypsy moth virus strains with and without the virus enhancer, Blankophor BBH. In: Fosbroke, Sandra L.C.; Gottschalk, Kurt W., eds. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 68-70. Abstract.

Valaitis, A.P.; Lee, M.K.; Dean, D.H. 1999. Purification, characterization and kinetic analysis of BTR-270, the Bacillus thuringiensis Cry1Aa/b toxin receptor in gypsy moth. In: Society for Invertebrate Pathology 1999, 32nd annual meeting; 1999 August 22-27; Irvine, CA. [Place of publication unknown]: [Publisher name unknown]: 76. Abstract.

Valaitis, Algimantas P.; Augustin, Sylvie, Clancy, Karen M. 1999. Purification and characterization of the western spruce budworm larval midgut proteinases and comparison of gut activities of laboratory-reared and field-collected insects. Insect Biochemistry and Molecular Biology. 29: 404-415.

Valaitis, Algimantas P.; Garner, Karen J. 1999. Cloning of a trehalase cDNA from the gypsy moth. FASEB Journal. 13 (7): A1392. Abstract 357.

Valaitis, Algimantas P.; Lee, Mi Kyong; Dean, Donald H. 1999. Isolation and kinetic analysis of the purified gypsy moth Cry 1 Aa/b Bacillus thuringiensis toxin receptor. In: Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 74. Abstract.

4509 Development of Biologically Based Controls for Forest Insect Pests and Diseases Through Molecular Technologies NE-4509

Problem 1 Fundamental development of biological agents and biorational approaches for insect control

FY1999 Research Attainment

Publications

Attainment

Gypsy moth virus research: The genome of the Lymantria dispar nuclear polyhedrosis virus (LdMNPV) was characterized through sequence determination and analyzed. An improved strain of LdMNPV with enhanced killing speed was developed by deletion of the ecdysteroid UDP-glucosyl transferase gene. A strain of LdMNPV was isolated and patented that exhibits stable polyhedra production in cell culture bioreactors. The isolation of this strain enables commercial scale virus production in bioreactors. A method of isolating strains of LdMNPV that retain wild-type levels of virion occlusion in polyhedra when produced in cell culture was developed and patented. Insect hormone research: The gypsy moth vitellogenin gene was cloned and sequenced, and was found to consist of seven exons interrupted by six introns. Sequence analysis of the promoter region revealed motifs associated with sex-specific and developmentally-regulated genes. The gypsy moth actin gene was cloned, sequenced, and used as a probe to characterize gene expression during diapause. The expression of this gene switched off during diapause, suggesting that actin gene expression could be used as a diagnostic marker for diapause
in insects. Mycorrhizal research: By sequencing genus-specific gene fragments, SCAR-PCR markers were developed for PCR-detection of mycorrhizal fungi Giagaspora margarita and Glomus intradices. Bacillus thuringiensis research: Very large differences in gut chymotrypsin and carboxypeptidase concentrations and significant differences in esterase and GsT activities were found in comparison of laboratory-reared and field-collected western spruce budworm. These findings have important implications involving the use of laboratory-reared insects for bioassyas of B. thuringiensis (Bt), and other insecticidal proteins processed by gut enzymes. We have cloned and sequenced (1) the gypsy moth receptor (APN-1) for Bt Cry1Ac toxin, (2) a putative Cry1Aa and Cry1Ab Bt toxin receptor, and (3) midgut trehalase. A novel membrane molecule (BTR-270) that binds Bt toxins with extraordinary high affinity was isolated, and studied. BTR-270 was used as a diagnostic probe to identify toxins that bind the receptor, and are highly toxic to gypsy moth.

4509 Development of Biologically Based Controls for Forest Insect Pests and Diseases Through Molecular Technologies NE-4509

Problem 2 Develop biological and biorational approaches for control of tree diseases

FY1999 Research Attainment

Publications

Research Unit

Eshita, Steven M. 1999. Use of 3-hydroxybenzoic acid as an internal standard for the quantitation of salicylic acid. In: Annual meeting of the American Society of Plant Physiologists; 1999 JULY 24-28; Baltimore, MD. Baltimore, MD: American Society of Plant Physiologists: 46: Abstract 94.

Koch, Jennifer L.; Eshita, Steven M.; Davis, Keith R.; Creelman, Robert A.; Seskar, Mirjana; Nakajima, Nobuyoshi Saji, Hikaru; Yasutani, Izumi:1999. Ozone sensitivity correlates with an insensitivity to both salicylic acid and jasmonic acid in hybrid poplar; the role of programmed cell death in lesion formation. In: Annual meeting of the American Society of Plant Physiologists; 1999 JULY 24-28; Baltimore, MD. Baltimore, MD: American Society of Plant Physiologists: 53-54, Abstract 136.

Koch, Jennifer Riehl; Scherzer, Amy J.; Eshita, Steven M.; Davis, Keith R. 1998. Ozone sensitivity in hybrid poplar is correlated with a lack of defense-gene activation. Plant Physiology. 118: 1243-1252.

Mason, Mary E.; Carey, David W.; Kamalay, Joseph C.; Koch, Jennifer L.; Eshita, Steven M.; Okuley, John J. 1999. Identification and expression Ophiostoma-elicitor induced genes in American elm. In: Annual meeting of the American Society of Plant Physiologists; 1999 JULY 24-28; Baltimore, MD. Baltimore, MD: American Society of Plant Physiologists: 175: Abstract 846.

Okuley, John J; Chaudry, Faisal; Mason, Mary E.; Carey, David W.; Koch, Jennifer; Kamalay, Joseph C.; Eshita, Steven M. 1999. Patterns of Ophiostoma elicitor indution of cloned pathogenesis related genes in American elm cells. In: Annual meeting of the American Society of Plant Physiologists; 1999 JULY 24-28; Baltimore, MD. Baltimore, MD: American Society of Plant Physiologists: 21: Abstract 32003.

Extramural

Schlarbaum, S.E.; Hebard, F.; Spaine, P.C.; Kamalay, J.C. 1998. Three American tragedies: chestnut blight, butternut canker and dutch elm disease. In: Britton, Kerry Ol, ed. Conference proceedings: exotic pests of eastern forests; 1997 APRIL 8-10; Nashville, TN. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: Nashville, TN: Southeast Exotic Pest Plant Council: 45-54.

Attainment

Dutch elm disease research: A novel method was developed for internal standard quantitation of salicylic acid and other aromatic acids from plants using 3-hydroxybenzoic acid. Differential display was used to clone and identify ten genes induced in American elm suspension cells by a fungal cell wall elicitor. Some of these genes were homologous to plant pathogenesis-related gene families while others were novel. RNA expression assays indicated that elicited cell suspensions derived from American elm trees which differed in susceptibility to DED also differed in both the timing and intensity of gene expression. Tree stress research: Previous studies established that an ozone-sensitive hybrid poplar clone (NE-388) has an attenuated level of ozone, pathogen, and wound-induced gene expression that is due to an inability to respond to the signal molecules jasmonic acid (JA) and salicylic acid (SA). Ethylene, another plant signal molecule, was determined to be produced to an equal extent in both clones. Differences in patterns of expression of ethylene biosynthetic enzymes indicated that JA and/or SA might play a role in their regulation. Direct evidence has been obtained that proves that ozone mimics a pathogen-induced hypersensitive response by triggering SA-mediated programmed cell death (PCD) in the ozone-tolerant clone (NE-245). In addition to PCD leading to ozone-induced lesion formation, a second mechanism of lesion formation independent of SA-induced PCD was characterized in NE-388. This mechanism involves toxic cell death as a result of the accumulation of active oxygen species beyond the antioxidant capacity of the cell. Earlier results have demonstrated that pretreatment of NE-245 with JA reduced subsequent ozone induced lesion formation. This effect was not observed in NE-388, indicating that JA modulates SA-dependent processes such as PCD.

4509 Development of Biologically Based Controls for Forest Insect Pests and Diseases Through Molecular Technologies NE-4509

Problem 3 Use of biotechnology to generate solutions to problems supporting current research

FY1999 Research Attainment

Publications

Research Unit Garner, K. J.; Slavicek, James M. 1999. Identification of a non-LTR retrotransposon from the gypsy moth. Insect Molecular Biology. 8(2): 1-12.

Attainment During efforts to generate DNA markers for use in distinguishing the Asian and North American gypsy moth strains a DNA clone was isolated that exhibited promise as a potential marker. Further investigation showed that the DNA sequence would not constitute a marker. However, the clone was found to be homologous to retrotransposons found in other insects. This clone was used as a probe to obtain a complete retrotransposon, which was then characterized. The retrotransposon was found to be a member of the non-long terminal repeats class of retrotransposons and is present as a highly repetitive genomic element in the gypsy moth. Two genes were found to constitute the retrotransposon 1) a DNA-binding GAG-like protein, and 2) an endonuclease/reverse transcriptase.

4557 Disturbance Ecology and Management of Oak-Dominated Forests
Gottschalk, Kurt W, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Vegetation dynamics in response to gypsy moth defoliation, other exotic organisms, and disturbances	408	.2	0	1	0
2. Landscape-scale population dynamics of gypsy moth and its use to develop management decisions	491	1	0	2	1
3. Silvicultural treatments for rehabilitating and regenerating oak forests	254	1.4	0	0	0
4. Models and decision support tools that synthesize and integrate disturbance effects and dynamics	223	1	0	1	0
M1. Maintain long-term studies of gypsy moth silvicultural practices and transfer technology to users	190	.4	1	0	0

4557 Disturbance Ecology and Management of Oak-Dominated Forests NE-4557

Problem 1 Vegetation dynamics in response to gypsy moth defoliation, other exotic organisms, and disturbances

FY1999 Research Attainment

Publications

Cooperative

Gottschalk, K.W.; Muzika, R.M.; Twery, M.J. 1999. Disturbance from gypsy moth defoliation and mortality: mediation by silvicultural treatments. In: Cook, J.E.; Oswald, B.P., comps. First biennial North American forest ecology workshop; 1997 JUNE 24-26; Raleigh, NC. Raleigh, NC: North Carolina State University: 381. Abstract.

Extramural

Davidson, Christopher B.; Gottschalk, Kurt W.; Johnson, James E. 1999. Tree mortality following defoliation by the European gypsy moth (Lymantria dispar L.) in the United States: a review. Forest Science. 45(1): 74-84.

Attainment

A major review presents information related to defoliation by the European gypsy moth (Lymantria dispar L.) and subsequent tree mortality in the eastern United States. The literature describing defoliation-induced tree mortality is extensive, yet questions still remain concerning (1) the association between initial stand composition and subsequent tree mortality, (2) the influence of site quality on tree mortality, and (3) observed differences between mortality rates in initial and subsequent outbreaks. Our review and analysis of the available literature indicates that initial species composition affects subsequent defoliation. Stands with predominantly susceptible host species have higher levels of species-specific and total mortality than mixed stands of susceptible, resistant, and immune host species. Differences in mortality on sites of varying productivity do not appear to be a direct result of site quality; rather, site quality indirectly influences mortality rates through its effect on species composiiton and therefore defoliation. Differences between initial and subsequent outbreaks appear to be due primarily to losses of vulneraable oaks and lower canopy species during the initial outbreak; oak mortality in initial outbreaks was found to be significantly greater than oak mortality in subsequent outbreaks.

4557 Disturbance Ecology and Management of Oak-Dominated Forests NE-4557

Problem 2 Landscape-scale population dynamics of gypsy moth and its use to develop management decisions

FY1999 Research Attainment

Publications

Cooperative

Gottschalk, Kurt W.; Muzika, Rose-Marie; Twery, Mark J. 1999. Managing forests for gypsy moth (Lymantria dispar L.) using silviculture: testing the effectiveness of silvicultural treatments in reducing defoliation and mortality. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 270. Abstract.

Liebhold, Andrew; McManus, Michael. 1999. The evolving use of insecticides in gypsy moth management. Journal of Forestry. 97(3): 20-23.

Liebhold, Andrew; Muzika, Rose-Marie; Sharov, Alexei; Williams, David. 1998. Landscape-level approaches to understanding gypsy moth population ecology. Recent Research Developments in Entomology. 2: 87-102.

Extramural

Sharov, Alexei A.; Liebhold, Andrew M. 1998. Model of slowing the spread of gypsy moth (Lepidoptera: Lymantriidae) with a barrier zone. Ecological Applications. 8(4): 1170-1179.

Sharov, Alexei A.; Pijanowski, Bryan C.; Liebhold, Andrew M.; Gage, Stuart H.; What affects the rate of gypsy moth (Lepidoptera: Lymantriidae) spread: winter temperature or forest susceptibility? Agricultural and Forest Entomology. 1: 37-45.

Attainment

A mathematical model of gypsy moth range expansion was developed to explore alternative strategies of spread management. The model assumed that isolated colonies became established beyond the infested front and that over time these colonies grew in area, coalescing to form a new infested front. The model was based upon field-estimated parameters including a pattern of decreasing colonization with distance from the infested front. The model predicted that eradication of isolated colonies, as part of a management program would result in a 54% reduction of the spread rate. Analysis of trap data from areas where a pilot program has been in place indicates that the program has resulted in a 59% reduction in spread. Thus, model predictions were close to the observed reduction. The model indicated several ways in which the effectiveness of such a management program can be optimized.

Historical gypsy moth pheromone trap capture data collected in Michigan from 1985 to 1994 were analyzed in order to evaluate the effect of winter temperature and forest susceptibility on rate of invasion. Over the entire area, populations spread at an average of 15.8 km/yr. Spread rate was higher in northern areas than to the south despite lower winter temperatures. The rate of spread was positively correlated with forest susceptibility as estimated from Forest Inventory and Analysis data.

4557 Disturbance Ecology and Management of Oak-Dominated Forests NE-4557

Problem 3 Silvicultural treatments for rehabilitating and regenerating oak forests

FY1999 Research Attainment

Publications

Cooperative

Johnson, James E.; Miller, Gary W.; Baumgras, John E.; West, Cynthia D. 1998. Assessment of residual stand quality and regeneration following shelterwood cutting in central Appalachian hardwoods. Northern Journal of Applied Forestry. 15(4): 203-210.

Perkey, Arlyn W.; Miller, Gary W.; Schuler, Thomas M. 1999. Regeneration results using two-aged management. In: For. Manage. Update 19. Morgantown, WV: U.S. Department of Agriculture, Forest Service, Northeastern Area, State and Private Forestry: 25.

Attainment

A total of 48 permanent 0.4-acre plots were installed in mature oak stands on the Monongahela National Forest to test the effect of subcanopy shelterwood treatments on reproduction of oak and competing species. Pretreatment data were collected on soil nutrient status, soil moisture, microsite light availability, stand density, status of advanced woody regeneration, and status of herbaceous vegetation. Approximately, 2,500 natural oak seedlings were measured and tagged for long-term study. Main factor treatments included two levels of deer exposure (control vs. fencing) and four levels of understory shade reduction (control, low, medium, and high). The shade reduction treatments were applied in July 1999. Collection of post-treatment data on soil moisture and microsite light availability were initiated in August 1999. The objective of this study is to quantify the effect of various light levels on the development of advanced oak regeneration and competing species. Funding ($10,000) was obtained in FY99 from the Forest Products Laboratory (WUEM Program) for this study. Arrangements with cooperating scientists were initiated to install replicates of this study in Pennsylvania and Ontario, Canada.

Data on woody and herbaceous vegetation were collected in 34 stands (494 plots) on the Monongahela National Forest to evaluate the vegetative conditions and management options in even-aged hardwood stands. These stands were clear-cut between 1964 and 1989 and are now occupied by natural hardwood regeneration. The stands are located on three ecological landtypes (Sugar maple-basswood series, Sugar maple-red oak series, and Red oak series) and vary from 9 to 33 years old. The objective of this study is to assess the relationship between ecological site classification and the pattern of vegetative conditions at various stages of development following large-scale disturbance. A secondary objective is to define silvicultural treatments needed on each ecological landtype to achieve desire future conditions. Funding ($32,000) was obtained in FY 99 from the Washington Office (CROPS Program) for this study. Preliminary results are scheduled to be presented in the Proceedings of the National Silvicultural Workshop in Kalispell, MT in October 1999. Data collection is planned for FY 2000 and FY 2001 to include additional ecological landtypes and age classes.

4557 Disturbance Ecology and Management of Oak-Dominated Forests NE-4557

Problem 4 Models and decision support tools that synthesize and integrate disturbance effects and dynamics

FY1999 Research Attainment

Publications

Extramural

Nanqing, Jiang; Colbert, J.J.; Wen, Jin; Rumei, Xu. 1997. A simplified model of foliage-gypsy moth-parasite system. In: Resource technology 1997: Beijing international symposium proceedings; 1997 SEPTEMBER 15-19; Beijing, China. Beijing, China: China Forestry Publishing House: 161-169.

Attainment

The smallest of the gypsy moth life system model formulations, the ordinary differential equation formulation was extended to provide additional analytic response analysis. The gypsy moth population that was previously modeled with a density dependent term has been replaced with foliage production-gypsy moth defoliation interactions and the natural enemy formulation has been strengthened to more accurately represent parasites and pathogens. The equilibrium and stability of this dynamical system has been described (Jiang et al. 1998). The Stand-Damage Model, a forest gap model, has been extended to permit users from areas outside of Appalachia to input additional tree species and the tree species help system has been reformatted and extended to provide additional support for users that require assistance in tree species identification. A new model for estimating the effects of defoliation on tree diameter growth has been produced.

The Stand-Damage Model (SDM) Interface, Java version 1.1, runs remotely on any web browser that supports Java 1.1 and passes the input data through a socket connection to the model running on a remote Server Computer. The output results from the model are passed back to the client's web browser and displayed in graphical or tabular form. There is a new application version of SDM that can be downloaded off the web. This application can print in graphical or tabular formats. The application version can also connect to the version running on a remote computer so that the latest version of the model can always be run. A SDM image map system is used to provide on-line help with menu and text field choices. The pilot system for the DOS version of the Stand-Damage Model has been completed.

4557 Disturbance Ecology and Management of Oak-Dominated Forests NE-4557

Problem M1 Maintain long-term studies of gypsy moth silvicultural practices and transfer technology to users

FY1999 Research Attainment

Publications

Research Unit Fosbroke, Sandra L.; Gottschalk, Kurt W., eds. 1999. Proceedings, U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species 1999; 1999 JANUARY 19-22; Annapolis, MD. Gen. Tech. Rep. NE-266. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 82.

Attainment A major study testing the effectiveness of silvicultural treatments in minimizing gypsy moth effects has completed its tenth growing season and will be remeasured this fall and winter. The continued growth and regeneration following defoliation will enhance our knowledge of treatment effectiveness. The five-year data showed presalvage thinning treatments reduce mortality resulting from gypsy moth defoliation. Sanitation thinning treatments also lower mortality but do not affect defoliation levels.

Two other studies continue to be monitored for gypsy moth defoliation. The Ohio study suffered some damage from high winds which will be monitored.

Several tours, presentations, and training sessions were conducted on the use of silvicultural treatments to minimize gypsy moth effects. Customer requests for and response to these sessions is strong.

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability
Long, Robert P, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Determine physiological and morphological changes of trees at different stages of development	101	.7	3	0	0
2. Determine how multiple interacting stressors (abiotic and biotic agents) affect tree health	385	2.4	4	4	0
3. Determine interacting roles of nutrition and site factors on tree declines and regeneration problems	289	1.9	2	0	3

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability NE-4558

Problem 1 Determine physiological and morphological changes of trees at different stages of development

FY1999 Research Attainment

Publications

Research Unit

McQuattie, Carolyn J.; Scherzer, Amy J. 1999. Leaf anatomy of different-aged sugar maple trees from four geographic sources. Ohio Journal of Science. 99(1): A-24. Abstract.

Rebbeck, J.; Scherzer, A.J. 1999. Ozone and enriched carbon dioxide effects on the growth of eastern white pine seedling after 5 years. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine; 181. Abstract.

Scherzer, A.J.; Rebbeck, J.; Boerner, R.E.J. 1998. Foliar nitrogen dynamics and decomposition of yellow-poplar and eastern white pine during four seasons of exposure to elevated ozone and carbon dioxide. Forest Ecology and Management. 109: 355-366.

Attainment

A five-year open-top chamber fumigation study with eastern white pine (Pinus strobus) revealed few significant ($P<0.10$) effects from treatments with twice ambient ozone (O3) and elevated (ambient+350 ppm) carbon dioxide (CO2). Trees were exposed to either charcoal-filtered air (CF), 1X ambient ozone (1XO3), 2X ambient ozone (2XO3), and 2X ambient ozone plus 350 ppm CO2 (2XO3+2XCO2) from May to October 1992-1996. In addition, seedlings originated from two genotypes: northwestern Ohio and the upper peninsula of Michigan. Seedling growth across treatments was highly variable for both genotypes though some consistent trends were evident. Analysis of growth and biomass variables suggests that O3 (both 1XO3 and 2XO3) reduced seedling biomass relative to CF-grown seedlings, and additions of twice ambient CO2 ameliorated those effects.

In conjunction with the above study, treatment effects on yellow-poplar (Liriodendron tulipifera) and eastern white pine foliar nitrogen dynamics and decomposition were examined from 1992 to 1995. Ozone alone did not alter foliar N concentrations in yellow-poplar; however, 2XO3+2XCO2 decreased N concentrations by 18-40%, depending on time of sampling, and yellow-poplar foliage decomposed more slowly after only one year of treatment. Treatments did not affect N concentration or decomposition of white pine needles during the first three years of exposure. By the fourth growing season, however, N concentrations of current year needles were reduced by 10-23%. Elevated CO2 in the presence of elevated O3 can reduce foliar N concentrations and reduce litter decomposition, thus affecting nutrient cycling.

A comparative study of four (OH, VT, MA, and NY) 36-year-old clonally propagated genotypes of sugar maple with their 9-year-old half-sib progeny revealed differences in leaf anatomy. Upper canopy leaves of the 36-year-old trees were thicker than lower canopy leaves, and lower canopy leaves from older trees were more similar in thickness to leaves from the half-sib progeny. Leaves with greater sun exposure had increased phenolic compounds in mesophyll cell vacuoles and decreased numbers of thylakoid grana stacks in mesophyll chloroplasts. Leaf anatomical characteristics of all genotypes were affected similarly by tree age and canopy position.

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability NE-4558

Problem 2 Determine how multiple interacting stressors (abiotic and biotic agents) affect tree health

FY1999 Research Attainment

Publications

Research Unit

Koch, Jennifer Riehl; Scherzer, Amy J.; Eshita, Steven M.; Davis, Keith R. 1998. Ozone sensitivity in hybrid poplar is correlated with a lack of defense-gene activation. Plant Physiology. 118: 1243-1252.

Loats, K.V.; Rebbeck, J. 1999. Interactive effects of ozone and elevated carbon dioxide on the growth and physiology of black cherry, green ash, and yellow-poplar seedlings. Environmental Pollution. 106: 237-248.

Long, R.P.; Davis, D.D. 1999. Growth variation of white oak subjected to historic levels of fluctuating air pollution. Environmental Pollution. 106: 193-202.

Scherzer, A.J.; Rebbeck, J.; Long, R.P. 1999. Effects of prescribed fire on foliar nutrients of oak, hickory, and red maple in a southern Ohio forest. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 187. Abstract.

Schier, George A.; McQuattie, Carolyn J. 1999. Effect of nitrogen source on aluminum toxicity in nonmycorrhizal and ectomycorrhizal pitch pine seedling. Journal of Plant Nutrition. 22(6): 951-965.

Extramural

Bailey, Sarah; Rebbeck, Joanne; Loats, Ken V. 1999. Interactive effects of elevated ozone plus carbon dioxide on duckweeds exposed in open-top chambers. Ohio Journal of Science. 99(2): 19-25.

Bosley, Augustus; Petersen, Raymond; Rebbeck, Joanne. 1998. The resistance of the moss Polytrichum commune to acute exposure of simulated acid rain or ozone compared to two fern species: spore germination. The Bryologist. 101(4): 512-518.

Gunthardt-Goerg, M.S.; McQuattie, C.J. 1998. Betula pendula: response to ozone in leaf, stem, and root cells. In: Tsekos, Ioannes; Moustakas, Michael, eds. Progress in botanical research: proceedings of the 1st Balkan botanical congress; 1997 SEPTEMBER 19-22; Thessaloniki, Greece. Dordrecht, Netherlands: Kluwer Academic Publishers: 427-430.

Peterson, Raymond L.; Bosley, Augustus; Rebbeck, Joanne. 1999. Ozone stimulates protonematal growth and gametophore production in Polytrichum commune. The Bryologist. 102(3): 398-403.

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability NE-4558

Problem 2 Determine how multiple interacting stressors (abiotic and biotic agents) affect tree health

FY1999 Research Attainment

Publications

Attainment

Various stressors that affect forest vegetation were evaluated as part of this problem. Low ozone (O3) concentrations were shown to induce increased cell wall thickness from pectin exudation in Betula pendula. Anatomical examination, even before O3 injury is barely visible to the naked eye, indicates the leaf has poorly defined cell structures with large fragmented vacuoles and cytoplasm tending to detach from the cell wall. In another study, potted seedlings of black cherry (Prunus serotina), green ash (Fraxinus pennsylvanica), and yellow-poplar (Liriodendron tulipifera) were used to evaluate the interactive effects of O3 and elevated carbon dioxide (CO2) during 10 weeks of treatments in continuously-stirred tank reactors. In general, growth of all three species was stimulated in 700 ppm CO2-air. Results indicate that responses to interacting stressors such as O3 and CO2 are species specific. The moss, Polytrichum commune, and two fern species, Athyrium felix-femina and Onoclea sensibilis were tested for sensitivity to simulated acid rain (SAR) and ozone based on spore germination. P. commune spore germination was resistant to short-term exposure to both acid rain (pH 2-7), and ozone (11, 50, 100 and 150 ppb). Both fern species had reduced spore germination at high O3 concentrations and appear sensitive to short-term acid rain and ozone exposures. Other cooperative research has shown that ozone tolerance in hybrid poplar is correlated with activation of salicylic-acid- and jasmonic-acid-mediated signaling pathways which are likely important in triggering defense responses to oxidative stress.

Aluminum (Al) toxicity can be a potentially serious problem in highly acidic soils. The form and amount of nitrogen (nitrate or ammonium) in the soil and whether seedlings are mycorrhizal or not, may affect whether Al is toxic to young seedlings. Both non-mycorrhizal and mycorrhizal (inoculated with Pisolithus tinctorius) pitch pine (Pinus rigida) seedlings were grown under controlled conditions and irrigated with nutrient solutions containing 0, 10, or 20 mg/L of Al and with elevated nitrate or ammonium at three times ambient levels. Elevated nitrate had no significant effect on Al toxicity in non-mycorrhizal seedlings, but Al toxicity was ameliorated by elevated ammonium.

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability NE-4558

Problem 3 Determine interacting roles of nutrition and site factors on tree declines and regeneration problems

FY1999 Research Attainment

Publications

Research Unit

McQuattie, Carolyn J.; Long, Robert P.; Hall, Thomas J. 1999. Sugar maple seedling anatomy and element localization at forest sites with different nutrient levels. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 59. Abstract.

Schier, G.A.; McQuattie, C.J. 1999. Response of sugar maple seedlings to manganese. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 188. Abstract.

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability NE-4558

Problem 3 Determine interacting roles of nutrition and site factors on tree declines and regeneration problems

FY1999 Research Attainment

Publications

Cooperative

Bailey, Scott; Horsley, Stephen B.; Long, Robert P.; Hallett, Richard A. 1999. Influence of geologic and pedologic factors on health of sugar maple on the Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 63-65.

Hallett, R.A.; Bailey, S.W.; Horsley, S.B.; Long, R.P.; Hall, T.J. 1999. Foliar chemistry and sugar maple health in the northeastern United States. In: Eckhoff, Janet D., ed. 2nd North American forest ecology workshop: forest ecology into the next millennium: putting the long view into practice; 1999 JUNE 27-30; Orono, ME. Orono, ME: University of Maine: 113. Abstract.

Hallett, Richard A.; Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hall, Thomas J. 1999. Foliar chemistry of sugar maple: a regional view. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 66. Abstract.

Horsley, S.; Long, R.; Bailey, S.; Hallett, R.; Hall, T. 1999. Factors contributing to decline-disease of sugar maple in Pennsylvania. In: 84th annual meeting: legacies, landscapes and limits: bridging borders: Ecological Society of America; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 112. Abstract.

Horsley, Stephen B.; Long, Robert P., eds. 1999. Sugar maple ecology and health, proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 120 p.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A. 1999. Factors contributing to the decline-disease of sugar maple on Pennsylvania's Allegheny Plateau. The Dropline. 2(4): 1.

Horsley, Stephen B.; Long, Robert P.; Bailey, Scott W.; Hallett, Richard A.; Hall, Thomas J. 1999. Factors contributing to sugar maple decline along topographic gradients on the glaciated and unglaciated Allegheny Plateau. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen.Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 60-62.

Long, R.; Horsley, S.; Stout, S.; Lilja, P.; Hall, T. 1999. Long-term research on forest nutrition and health in north central Pennsylvania. In: 84th annual meeting: legacies, landscapes and limits: bridging borders: Ecological Society of America; 1999 AUGUST 8-12; Spokane, WA. Washington, DC: Ecological Society of America: 275. Abstract.

Long, Robert P.; Horsley, Stephen B.; Lilja, Paul R. 1999. Impact of forest liming on growth, vigor, and regeneration of sugar maple and associated hardwoods. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol. 1. The effects of acidic deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Insititute: 263-264. Abstract.

Long, Robert P.; Horsley, Stephen B.; Lilja, Paul R. 1999. Impact of forest liming on growth, vigor, and reproduction of sugar maple and associated hardwoods. In: Horsley, Stephen B.; Long, Robert P., eds. Sugar maple ecology and health: proceedings of an international symposium; 1998 JUNE 2-4; Warren, PA. Gen. Tech. Rep. NE-261. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 55-58.

4558 Multiple Stress Interactions and Their Effects on Forest Health and Sustainability NE-4558

Problem 3 Determine interacting roles of nutrition and site factors on tree declines and regeneration problems

FY1999 Research Attainment

Publications

Extramural

Swistock, Bryan R.; DeWalle, David R.; Horsley, Stephen B.; Long, Robert P.; Hall, Thomas J.; Bailey, Scott. 1999. Soil water chemistry in declining and non-declining sugar maple stands. In: Sharpe, William E.; Drohan, Joy R., eds. Proceedings of the 1998 Pennsylvania acidic deposition conference. Vol 1. The effects of acid deposition on Pennsylvania's forests; 1998 SEPTEMBER 14-16; University Park, PA. University Park, PA: The Pennsylvania State University, Environmental Resources Research Institute: 63-72.

Attainment

A long-term liming study in cooperation with NE-4152 and the Pennsylvania Bureau of Forestry, has continued to provide new insights on overstory growth and survival of the principal overstory species, sugar maple (Acer saccharum), black cherry (Prunus serotina), and American beech (Fagus grandifolia). Growth and vigor of sugar maple continued to improve through 1997 in response to liming. Black cherry and American beech have been unaffected by the treatments, indicating that response to liming is species specific. Sugar maple seedling regeneration was also shown to be enhanced by liming. Examination of destructively sampled seedlings indicated limed seedling roots had mycorrhizal colonization averaging 66% compared with only 21% for unlimed seedlings. Precipitates analyzed by x-ray analysis in root xylem and cortical cells from the unlimed seedlings were composed of Mn and dense materials likely composed of phenolics or defensive compounds. A controlled study to evaluate manganese sensitivity of non-mycorrhizal sugar maple seedlings showed symptoms of Mn toxicity which included chlorosis and necrosis in leaves, darkened root tips, and loosening of outer cortical cells of roots. Seedlings were treated with 0.1, 5, 10, 20, 40 and 80 mg/L Mn. Seedling mortality was 92% at 40 and 100% at 80 mg/L Mn. At lower Mn, seedling dry weight decreased with increasing Mn concentrations.

Additional cooperative research with NE-4152, 4352, and 4155, has revealed the interaction between foliar magnesium nutrition and incidence and severity of defoliation in the past 10 years as the key factors that predispose trees to and incite the decline-disease of sugar maple on unglaciated portions of the Allegheny Plateau. Sites with significant sugar maple decline were all located on unglaciated summit, shoulder or upper backslope physiographic positions. Stands on glaciated sites and unglaciated lower landscape positions were healthy. The lowest foliar Mg, the highest foliar Mn and the highest number and severity of defoliations were associated with summits, shoulders or upper backslopes where decline is most severe. Additional research has revealed the relationship between landscape position and bedrock mineralogy. Unglaciated lower slopes are sometimes associated with calcareous bedrock such as the Oswayo and Huntley Mountain Formations which contribute base cations to soils and provide trees with greater amounts of available nutrients.

4701 Efficient Use of the Northern Forest Resource
Baumgras, John E, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Effects of silviculture and forest operations on wood quality and utilization opportunities	431	1.3	0	3	1
2. Need to identify and evaluate opportunities for improving efficiency of resource utilization	628	1.5	9	5	1

4701 Efficient Use of the Northern Forest Resource NE-4701

Problem 1 Effects of silviculture and forest operations on wood quality and utilization opportunities

FY1999 Research Attainment

Publications

Cooperative

Baumgras, John E.; Luppold, William. 1999. Timber inventory and sales on northeastern U.S. national forests. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of Canadian and northeastern forests economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service: 220-230.

Luppold, William G.; Baumgras, John E. 1999. The interaction between forest industry and the forest resource in West Virginia. Proceedings, improving forest productivity for timber...a key to sustainability; 1998 DECEMBER 1-3; Duluth, MN. [Place of publication unknown]: [Publisher name unknown]: 159-164.

Luppold, William G.; Baumgras, John E.. Changes in national forest timber sales in the central hardwood region. In: Stringer, Jeffrey W.; Loftis, David L., eds. 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 3-8.

Luppold, William G.; Baumgras, John E.; Barrett, George. 1999. Characteristics of the eastern hardwood sawmilling industry. In: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society: 50. Abstract.

Extramural

Bragg, Don C.; Mroz, Glenn D.; Reed, David R.; Shetron, Stephen G.; Stokke, Douglas D. 1997. Relationship between "birdseye" sugar maple (Acer saccharum) occurrence and its environment. Canadian Journal of Forest Research. 27: 1182-1191.

Bragg, Don C.; Stokke, Douglas D. 1999. Annotated bibliography on "birdseye" figured grain. Gen. Tech. Rep. NE-263. Radnor, PA: U.S. Department of Agriculure, Forest Service, Northeastern Research Station: 15.

Phelps, John E. 1998. An assessment of root collars in Ozark forest ecosystems following forest operations--a review of the literature. In: Res. Pub. No. NS-004. Carbondale, IL: Southern Illinois University, Department of Forestry: 26.

Attainment

Research progress in FY99 includes continuing development of a dataset containing detailed information on hardwood tree and log form, defects, and yields. Coupled with software being developed to generate tree and log topology, this new dataset is opening new avenues for research into identifying more resource efficient methods of processing hardwood timber and learning how tree attributes affected by forest management practices impact wood utilization. Cooperative research developing tree-bucking optimization software to improve the quality and value of roundwood products harvested from Appalachian hardwoods also continued in FY99. Research initiated in FY99 includes studies to: 1) determine the attributes and requirements of high-valued hardwood veneer logs - information that can be used to improve timber harvesting practices and help link wood quality to forest management practices; 2) determine the impacts of forest management practices, rotation length, and forest site attributes on wood quality and product yields for Lake States hardwoods; and 3) investigate relationships between external indicators and internal sawlog defects - information needed to improve hardwood sawlog processing methods and to better understand the impacts of forest management practices on wood quality.

4701 Efficient Use of the Northern Forest Resource NE-4701

Problem 2 Need to identify and evaluate opportunities for improving efficiency of resource utilization

FY1999 Research Attainment

Publications

Research Unit

Blackwell, Kyle; Wiedenbeck, Janice K. 1999. SIP again! Or sawmill improvement program revisited. In: Biographies & abstracts: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society: 50. Abstract.

Gatchell, Charles J.; Thomas, R. Edward.; Walker, Elizabeth S. 1999. Effects of preprocessing 1 common and 2A common red oak lumber on gang-rip-first rough-mill dimension part yields. Forest Products Journal. 49(3): 53-60.

Thomas, Edward; Bush, Kristen. 1998. Decision-support software for optimizing rip-first and chop-first systems. In: ScanPro1998: 8th international conference on scanning technology & process optimization for the wood products industry; 1998 NOVEMBER 4-6; Vancouver, BC. San Francisco, CA: Miller Freeman, Inc: 155-164.

Thomas, Edward; Bush, Kristen. 1998. Log scanning: an alternative approach. In: ScanPro 1998: 8th international conference on scanning technology & process optimization for the wood products industry; 1998 NOVEMBER 4-6; Vancouver, BC. San Francisco, CA: Miller Freeman, Inc: 141-151.

Thomas, R. Edward. 1999. Analyzing hardwood log surfaces to determine interior characteristics. In: Biographies & abstracts: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society: 28. Abstract.

Thomas, R. Edward. 1999. ROMI-RIP 2.0 user's guide: a rough mill rip-first simulator. Gen. Tech. Rep. NE-259. Radnor, PA: U.S.Department of Agriculture, Forest Service, Northeastern Research Station: 64.

Thomas, R. Edward. 1999. ROMI-RIP version 2.0: a new analysis tool for rip-first rough mill operations. Forest Products Journal. 49(5): 35-40.

Wiedenbeck, Jan. 1999. Profiles in leadership: SITA Warren or...women's work...in wood products, revisited. Forest Products Journal. 49(4): 4.

Wiedenbeck, Janice K. 1998. Women's work...in wood products. Forest Products Journal. 48(7/8): 12-23.

Cooperative

Johnson, James E.; Miller, Gary W.; Baumgras, John E.; West, Cynthia D. 1998. Assessment of residual stand quality and regeneration following shelterwood cutting in central Appalachian hardwoods. Northern Journal of Applied Forestry. 15(4): 203-210.

Luppold, William G.; Baumgras, John E. 1999. Short and long term relationships between hardwood lumber and stumpage prices. Abt, Karen Lee; Abt, Robert C., eds. Proceedings of the 1998 southern forest economics workshop; 1998 MARCH 25-27; Williamsburg, VA. Raleigh, NC: North Carolina State University: 106-111.

4701 Efficient Use of the Northern Forest Resource NE-4701

Problem 2 Need to identify and evaluate opportunities for improving efficiency of resource utilization

FY1999 Research Attainment

Publications

Extramural

Buehlmann, Urs; Kline, D. Earl; Wiedenbeck, Janice K.; Noble, Robert. 1999. Lumber yield maximization for rip-first rough mills. In: Biographies & abstracts: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society: 32. Abstract.

Buehlmann, Urs; Wiedenbeck, Janice K.; Kline, D. Earl. 1999. Character-marked furniture: potential for lumber yield in crosscut-first rough mills. Forest Products Journal. 49(2): 65-72.

Moody, John; Gatchell, Charles J.; Walker, Elizabeth S.; Klinkhachorn, Powsiri. 1998. An introduction to UGRS: the ultimate grading and remanufacturing system. Forest Products Journal. 48(9): 45-50.

Moody, John; Gatchell, Charles J.; Walker, Elizabeth S.; Klinkhachorn, Powsiri. 1998. User's guide to UGRS: the ultimate grading and remanufacturing system (version 5.0). Gen. Tech. Rep. NE-254. Radnor, PA: U.S.Department of Agriculture, Forest Service, Northeastern Research Station: 40.

Steele, Philip H.; Wiedenbeck, Janice K.; Shmulsky, Rubin. 1999. The influence of hardwood lumber grade on rough mill machine productivity. In: Biographies & abstracts: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society: 32. Abstract.

Attainment

Significant progress was made in developing and field testing a more usable system for analyzing sawmill production and yields, developing guidelines for system implementation, and training users in system applications. The objectives of this research are to extend the hardwood resource and sustain forest-based industries by promoting more efficient processing of hardwood sawlogs. Progress also was made developing and testing a lumber scanning system for digitizing lumber dimensions and defect locations. This technology will speed development of digitized lumber databases that are essential to identifying more resource efficient lumber processing systems. In cooperation with NA S&PF and Menominee Tribal Enterprises (MTE), NE-4701 also completed a new lumber database by digitizing the dimensions and defect locations of 20,000 board feet of white pine lumber. This database, when coupled with lumber processing simulation software recently developed by NE-4701 (ROMI-CROSS and ROMI-RIP 2.0), enables MTE and other eastern white pine processors to identify resource efficient lumber processing alternatives and value-added opportunities. Research completed and reported in FY99 included a series of publications that 1) introduce and demonstrate applications of new lumber processing simulation and grading software (ROMI-RIP 2.0 and UGRS), 2) identify opportunities for improving lumber yields and grades by preprocessing and remanufacturing hardwood lumber, and 3) show furniture manufacturers how to improve product recovery by utilizing character-marked lumber.

Forest Engineering Research-Systems Analysis to Evaluate Alternative Harvesting Strategies
LeDoux, Chris B, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Inadequate management planning models for forest operations and forest product transportation	120	.5	3	0	0
2.	Lack of complete symthesis on all aspects of the forest operations process, selection of the harvesting process, multiproduct harvesting, loss caused by log damage and other procedures	80	.5	0	0	1

4751 Forest Engineering Research-Systems Analysis to Evaluate Alternative Harvesting Strategies NE-4751

Problem 1 Inadequate management planning models for forest operations and forest product transportation

FY1999 Research Attainment

Publications

Research Unit

LeDoux, C.B.; Gopalakrishnan, B.; Pabba, R.S. 1998. THINEX - An expert system for estimating forest harvesting productivity and cost. In: Gopalakrishnan, B.; Murugesan, San, eds. Proceedings of The International Society for Optical Engineering; 1998 NOVEMBER 2-4; Boston, MA. Bellingham, WA: The International Society for Optical Engineering: 262-272.

LeDoux, Chris B. 1999. An integrated approach for determining the size of hardwood group-selection openings. Forest Products Journal. 49(3): 34-37.

LeDoux, Chris B. 1999. Harvesting strategies for increasing the availability and quality of hardwood fiber. In: Stringer, Jeffrey W.; Loftix, David L., eds. Proceedings, 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 137-140.

Attainment

A study was conducted that integrated results from several cable and ground-based logging studies with those from several regeneration studies to determine the most effective size of group-selection openings. Results suggest that managers can maximize financial yields by using group-selection units of 1.25 acres or larger. Results from another study show that financial yields and fiber production can be increased and made available earlier in the life of a stand by matching size of harvesting machines to the size of wood being harvested. Gains of up to 40 percent in present net worth can be attained by early thinning of a stand when harvesting machines are matched to wood size harvested. The results should be valueable to forest planners and managers. Results of this research have been presented to resource managers, policy makers, loggers, and other researchers through publications, symposia, and other technology transfer efforts.

4751 Forest Engineering Research-Systems Analysis to Evaluate Alternative Harvesting Strategies NE-4751

Problem 2 Lack of complete symthesis on all aspects of the forest operations process, selection of the harvesting process, multiproduct harvesting, loss caused by log damage and other procedures

FY1999 Research Attainment

Publications

Cooperative

Hewitt, Daphne; Huyler, Neil; Hannah, Peter; LeDoux, Chris. 1998. Determining time as a cost in constructing waterbars on forest sites in Vermont. In: Schiess, Peter and Krogstad, Finn, eds. Proceedings of the Council on Forest Engineering; 1998 JULY 20-23; Portland, OR. Seattle, WA: University of Washington: 1-8.

Attainment

A study was conducted that developed the production and cost information for constructing waterbars on forest sites in Vermont to meet BMP standards. Results show that the dimensions of the waterbar has the greatest effect on time, and the horsepower of the machine used appears to override moderate site conditions. Results show that operator experience and construction method were also important factors in determining time and cost to construct waterbars. This study provides detailed field measurements, time, and costs required to install a waterbar. Results of this research have been presented to resource managers, policy makers, loggers, and other researchers through publications, symposia, and other technology transfer outlets.

4801 Forest Inventory and Analysis
Peters, John R, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Conduct periodic forest resources inventories and evaluations	3,076	1.1	5	0	0
2. Conducting special analyses of specific resource issues and concerns	765	1.4	4	0	1

4801 Forest Inventory and Analysis NE-4801

Problem 1 Conduct periodic forest resources inventories and evaluations

FY1999 Research Attainment

Publications

Research Unit

Wharton, Eric H.; Martin, Thomas D.; Widmann, Richard H. 1998. Wood removals and timber use in New York, 1993. Resour. Bull. NE-141. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 28.

Wharton, Eric H.; Birch, Thomas W. 1999. Trends in timber use and product recovery in New York. Res. Note NE-367. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station: 7.

Wharton, Eric H.; Griffith, Douglas M. 1999. Estimating total forest biomass in Maine, 1995. Resour. Bull. NE-142. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 50.

Widmann, Richard H.; Griffith, Douglas M. Pulpwood production in the Northeast-1997. Resour. Bull. NE-144. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeasten Research Station: 20.

Widmann, Richard H.; Wharton, Eric H.; Murriner, Edward C. 1998. West Virginia timber products output: 1994. Resour. Bull. NE-143. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 15.

Cooperative

Luppold, William G.; McWilliams, William H. 1999. Issues affecting the interpretation of eastern hardwood resource statistics. In: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society; 50. Abstract.

Attainment

The project completed periodic inventories in six states: Connecticut, Massachusetts, New Jersey, New Hampshire, Rhode Island, and Vermont; and is proceeding towards completion in Delaware, Maryland, and West Virginia. The work includes remeasurement of sample locations that were affected by the 1998 Ice Storm in New Hampshire, New York, and Vermont. The project has accelerated its efforts towards implementing a new annual inventory system for northeastern States. The first state in the annual inventory was started in Maine. Maine is the first state in the Nation to be inventoried using new national protocols developed to achieve consistency in regional forest inventories. In addition, a pilot of the annual system was started in Pennsylvania as part of the multi-agency Delaware River Basin Assessment. A highlight of the annual system is the integration of Forest Health Monitoring and Forest Inventory and Analysis sample locations and measurements.

Planning efforts have begun for the next National Ownership Study that will address the major demographic and social aspects of private forest-land ownership. The study will further address changes in the character of private owners and their underlying objectives for forest management.

Forest inventories were expanded to cover urban forest land in a study affiliated with the Long-Term Ecological Site in the Baltimore Metropolitan area. This research will evaluate urban forest settings, tree density, and species composition for land not previously covered in traditional forest inventories.

Publications for the year focused on getting information on wood biomass, use and recovery into the hands of customers. Reports on biomass resources of Maine, wood recovery and timber use in New York, timber products output in West Virginia, and pulpwood production for Northeastern States were published.

4801 Forest Inventory and Analysis NE-4801

Problem 2 Conducting special analyses of specific resource issues and concerns

FY1999 Research Attainment

Publications

Research Unit

King, Susan L. 1998. Cluster optimization for a Honduran forest survey. In: Partnering for global technology management; 1998 OCTOBER 25-28: Seattle, WA. [Place of publication unknown]: Institute for Operations Research and the Management Sciences: 14. Abstract.

King, Susan L. 1999. Neural networks vs. multiple linear regression for estimating previous diameter. In: Stringer, Jeffrey W.; Loftis, David L., eds. Proceedings, 12th Central Hardwood Conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 159-166.

King, Susan L.; Arner, Stanford L. 1999. Estimating previous diameter for ingrowth trees on remeasured horizontal point samples. In: Stringer, Jeffrey W.; Loftis, Daniel L., eds. Proceedings, 12th Central Hardwood Conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 152-158.

Riemann Hershey, Rachel R.; Reese, Gordon. 1999. Creating a "first-cut" species distribution map for large areas from forest inventory data. Gen. Tech. Rep. NE-256. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 10.

Cooperative

Reynolds, Keith; Bjork, Jennifer; Reimann Hershey, Rachel R.; Schmoldt, Dan; Payne, John; King, Susan; DeCola, Lu; Twery, Mark; Cunningham, Pat. 1999. Decision support for ecosystem management. In: Sexton, W.T.; Szaro, R.C.; Johnson, N.C.; Malk, A.J., comps., eds. Ecological stewardship: a common reference for ecosystem management. [Place of publication unknown]: Elsevier Science Ltd.: 687-721.

Attainment

An array of operational technologies to address expanding customer needs are being developed and tested. Techniques research is addressing the implementation of satellite remote sensing, forest-land classification, urban forest inventories, spatial representation of inventory results, and annual inventory methods.

A variety of satellite data are being explored with the intent of improving the speed and efficiency of classifying forest-land. One promising approach is the integration of coarse-scale AVHRR digital imagery with modeled enhancement using Thematic Mapper data. In addition, other sources of satellite information will be adapted according to needs of individual Northeastern States. These results will mesh with the implementation of annual inventories.

New ways of presenting and displaying forest inventory results in a spatial context are expanding the projects ability to assess resource character across traditional boundaries. A variety of resource attributes, such as forest-type group, stand size, and mortality are being added to the analyst's toolkit for addressing issues for forest sustainability and health.

Research comparing methods for annual inventories are continuing in an effort to streamline implementation across the northeast. Studies have focused on estimating previous tree diameters, infgrowth, and alternate sample protocols.

Research Unit NE-4803

4803 Economics of Eastern Forest Use
Hansen, Bruce G, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	Information is needed on all markets for roundwood and on principal consumers and hardwood lumber and wood fiber on continuing basis	797	1.5	4	5	0
2.	Research is needed on viable, market-based, value-added product opportunities that improve use of forest resource	253	1	6	0	0

4803 Economics of Eastern Forest Use NE-4803

Problem 1 Information is needed on all markets for roundwood and on principal consumers and hardwood lumber and wood fiber on continuing basis

FY1999 Research Attainment

Publications

Research Unit

Emanuel, David; Rhodes, Carol. 1999. Bulletin of hardwood market statistics: 1998. Res. Note NE-369. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station: 22.

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Cooperative

Johnson, James E.; Miller, Gary W.; Baumgras, John E.; West, Cynthia D. 1998. Assessment of residual stand quality and regeneration following shelterwood cutting in central Appalachian hardwoods. Northern Journal of Applied Forestry. 15(4): 203-210.

Extramural

Anonymous. 1999. Bright lumber supply outlook. Pallet Talk. 5: 1, 6-7.

Anonymous. 1999. Comparison of lumber consumption estimates in the primary market sectors, 1991 and 1997. Hardwood Market Report. 77(1): 7.

Anonymous. 1999. Has pallet production in U.S. topped out? Pallet Profile Weekly. June: 1-2.

Anonymous. 1999. New industry benchmarks coming. Pallets in Brief. February: 1-2.

Anonymous. 1999. Pallet production numbers unveiled. Pallets in Brief. June: 1.

Attainment

Increasing globalization of the U.S. economy and the growing importance of the export market has resulted in a call for information by state utilization specialists, resource managers, and others to help them assess the impact of the export market on their domestic economies, forest resources, and wood products industries. In response, scientists within the work unit reviewed the availability and adequacy of published nationwide data sources that purport to have information on the state-of-origin of wood product exports. Five source documents were found to which all published export data could be traced. All were found to be deficient or inadequate in one or more ways. Barcoding of logs with species and volume information at the source of their harvest, and subsequent transfer of this information at the point of further manufacture or port of export, was seen as perhaps the only solution to accurate tracking.

It is estimated that manufacture of wooden pallets accounts for over 1/3 of total hardwood lumber consumed annually in the United States. Project scientists collaborated with the National Wooden Pallet and Container Association on a methodology to track pallet production and production trends on a monthly basis. This information will be combined with information from a study on new and recycled wood use in wood pallet production to estimate resource impacts on a continuing basis.

Cooperation between the work unit and the New York State Department of Environmental Conservation was initiated to explore ways to assess wood production and consumption in the state of New York on an annual or biannual basis. This study will be used as a prototype for solicitation of additional cooperation from other states comprising the Northeastern Research Station.

4803 Economics of Eastern Forest Use NE-4803

Problem 2 Research is needed on viable, market-based, value-added product opportunities that improve use of forest resource

FY1999 Research Attainment

Publications

Research Unit

Bumgardner, Matthew; Bush, Robert J.; West, Cynthia D. 1999. Character-mark usage in the furniture industry: barriers to acceptance. Research Update. April: 1-2.

Bumgardner, Matthew; Bush, Robert J.; West, Cynthia D. 1999. Character-mark usage in the furniture industry: overcoming barriers. Research Update. August: 1-2.

Hansen, Bruce G.; Palmer, Arnold J., Jr. 1999. FRAN: financial ratio analysis and more (version 2.0 for windows). [Computer program]. Gen. Tech. Rep. NE-264. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. [1 computer disk] (3-1/2 in.)].

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Attainment

Inclusion of character marks (i.e., naturally occurring features such as knots, holes, swirls, bird peck, etc.) in furniture parts offers considerable opportunities to increase yield and extend resource supplies and use. Barriers restraining the use of character-marks in hardwood furniture were found to include: (1) difficulty in establishing and communicating standards that satisfy later manufacturing and marketing requirements, (2) manufacturing issues involved with character-mark repair, and distribution and orientation within the piece, (3) an information gap between manufacturers, retailers, and consumers, and (4) a lack of information on consumer response to inclusion of character-marks.

In addition to character-mark research, "brown" (non-white) hard maple panels were exhibited at the Greensboro equipment show, the New York State Fair, and Interzum, Hanover, Germany. Panels varied on the basis of color, finish, and mineral content. Results suggested a wide variety of tastes and preferences. Respondents at Greensboro reflected a manufacturing bias of participants with preferences tending toward light brown color, natural finish, with no mineral stain. Respondents at the NYS Fair were mostly consumers. Their choices were of most interest and varied by application. They preferred the medium brown color in the cherry finish with mineral stain for the living room, dining room, and bedroom furniture. In the kitchen they expressed a preference for light color with no mineral. In floors, they preferred mixed colors and stain. Interzum respondents reflected European tastes. Most preferred mixed colors, natural finish, and mineral free.

4805-Enhancing the Performance & Competitiveness of U.S. Hardwood Industry
Luppold, William George, Project Leader

FY 1999 Research Attainments
Research Unit Summary

	Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1.	An analysis of the structure, conduct, and performance of the various hardwood products industries	38	.3	0	0	3
2.	Assessing alternative intervention approaches to remedy externalities from production/processing timber	88	.7	3	0	3
3.	Explore strategies that help hardwood processing firms and industries to remain competitive	0	0	0	0	0

4805-Enhancing the Performance & Competitiveness of U.S. Hardwood Industry NE-4805

Problem 1 An analysis of the structure, conduct, and performance of the various hardwood products industries

FY1999 Research Attainment

Publications

Cooperative

Luppold, William G.; Baumgras, John E. 1999. Short and long term relationships between hardwood lumber and stumpage prices. Abt, Karen Lee; Abt, Robert C., eds. Proceedings of the 1998 southern forest economics workshop; 1998 MARCH 25-27; Williamsburg, VA. Raleigh, NC: North Carolina State University: 106-111.

Luppold, William G.; Baumgras, John E.; Barrett, George. 1999. Characteristics of the eastern hardwood sawmilling industry. In: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society: 50. Abstract.

Luppold, William G.; McWilliams, William H. 1999. Issues affecting the interpretation of eastern hardwood resource statistics. In: Forest Products Society 53rd annual meeting; 1999 JUNE 27-30; Boise, ID. Madison, WI: Forest Products Society; 50. Abstract.

Attainment

The hardwood industry is rapidly changing. Fifteen years ago the hardwood sawmilling industry was composed of relatively small privately owned and independently operated mills. In recent years the growth in the timber base and economies of scale in production and distribution have caused mill size to increase and an increase in the number of multiple mill operations. These larger operations tend to have greater dry kiln capacity and more capital intense mills. The large multiple mill operations have a disproportionate share of the export market indicating a disproportionate demand for higher grade timber. However, close examination of past growth, drain ration, and current timber product output studies indicate that rapid timber growth that allowed mill size to increase may be slowing down. Another source of change in the hardwood industry is an increased demand for fiber by pulp and engineered wood product firms. The great volumes of materials consumed by these firms have been a subject of concern with persons associated with the sawmilling industry and environmentalists. However, the proportion of the gross hardwood growing stock in cull trees or cull portion of trees is considerably greater than the proportion of cull material in gross softwood growing stock. What this means is that an analysis of the impact of these new industry growing stock volumes must be analyzed with the knowledge that these industries may be consuming large quantities of cull materials that are not normally considered growing stock.

4805-Enhancing the Performance & Competitiveness of U.S. Hardwood Industry NE-4805

Problem 2 Assessing alternative intervention approaches to remedy externalities from production/processing timber

FY1999 Research Attainment

Publications

Research Unit

Luppold, William G. 1999. Revisiting storm water discharge regulations and their cost. National Hardwood Magazine. 73(2): 49,62-65.

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Cooperative

Baumgras, John E.; Luppold, William. 1999. Timber inventory and sales on northeastern U.S. national forests. In: MacFarlane, Derek; Dennis, Donald, eds. Proceedings of the joint meeting of Canadian and northeastern forests economists; 1998 JUNE 23-25; Fredericton, NB. Fredericton, NB: Canadian Forest Service: 220-230.

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Luppold, William G.; Baumgras, John E.. Changes in national forest timber sales in the central hardwood region. In: Stringer, Jeffrey W.; Loftis, David L., eds. 12th central hardwood forest conference; 1999 FEBRUARY 28-MARCH 1-2; Lexington, KY. Gen. Tech. Rep. SRS-24. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 3-8.

Attainment

For several decades the eastern national forests have been a source of timber for the primary hardwood processing industry. Although national forests contain only 7 percent of the eastern hardwood sawtimber volume, the quality of this timber is superior to privately owned timber on adjoining lands. A study of national forest timber cut from 1985 to 1997 for Lake States, northern Appalachian mountains, and southern Appalachian mountains regions found that roundwood sales have decreased in all the regions. However, sales revenues have increased in the Lake States and northern Appalachian mountains regions because roundwood prices have increased more than the decrease in sales volumes. The increase in revenue in the Lake States emanated from increased pulpwood prices while the increase in revenues in the northern Appalachian mountains resulted from increased prices for black cherry and red oak. The southern Appalachian mountains were the only region that experienced a decline in roundwood sales revenues. The hardwood industry is also facing increased environmental regulations including increased scrutiny of storm water discharge. Analysis of state storm water regulations found considerable variations in permit cost and requirements. This variation was a result of different priorities, levels of human and financial resources, and the continual evolution of federal guidelines pertaining to these permits. The analysis also found that industry associations have worked with government agencies in establishing permit requirements.

4805-Enhancing the Performance & Competitiveness of U.S. Hardwood Industry NE-4805

Problem 3 Explore strategies that help hardwood processing firms and industries to remain competitive

FY1999 Research Attainment

Publications

Attainment Research in this problem area has been curtailed as researchable problems in problem areas 1 and 2 have been integrated into publications developed for problem area 2.

4952 Structure and Function of Urban Forests
Nowak, David J, Project Leader

FY 1999 Research Attainments
Research Unit Summary

Problem number and title	Current funding ($1,000)	Current staffing (scientist years)	Research unit	Extra-mural	Cooper-ative
1. Understand how presettlement forest structure and function is changing as a result of urbanization	410	3	7	8	0
2. Understand changes in energy, water, and pollutant flux associated with land use changes	430	2	6	3	2

4952 Structure and Function of Urban Forests NE-4952

Problem 1 Understand how presettlement forest structure and function is changing as a result of urbanization

FY1999 Research Attainment

Publications

Research Unit

Belt, K.T.; Gresens, S.E.; Gwinn, D.C.; Banks, P.; Tang, J.A. 1999. The effects of urban impervious watershed cover on benthic macroinvertebrate populations in streams, with particular reference to disturbance from storm event frequency and magnitude. Bulletin of the North American Benthological Society. 16(1): 208. Poster Abstract.

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Gresens, Susan E.; Belt, Kenneth T.; Gwinn, Daniel C.; Tang, Jamie T. 1998. Stream invertebrate community response to increased watershed imperviousness. Bulletin of the Ecological of America. 79: 63. Presentation Abstract.

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Russell, William H.; McBride, Joe; Rowntree, Rowan. 1998. Revegetation after four stand-replacing fires in the Lake Tahoe Basin. Madrono. 45(1): 40-46.

Extramural

Mitchell, Myron J.; Driscoll, Charles T.; Kahl, Jeffrey S.; Likens, Gene E.; Murdoch, Peter S.; Pardo, Linda H. 1996. Climatic control of nitrate loss from forested watersheds in the Northeast United States. Environmental Science and Technology. 30(8): 2609-2612.

Ohrui, Kiyokazu; Mitchell, Myron J.; Bischoff, Joseph M. 1999. Effect of landscape position on N mineralization and nitrification in a forested watershed in the Adirondack Mountains of New York. Canadian Journal of Forest Research. 29: 497-508.

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Whitall, David. 1997. The quality of litter collected along a pollution gradient in the northeastern United States. In: Occas. Publ. 11. Millbrook, NY: Institute of Ecosystem Studies: 44-49. [Pouyat, acting as mentor scientist.]

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4952 Structure and Function of Urban Forests NE-4952

Problem 1 Understand how presettlement forest structure and function is changing as a result of urbanization

FY1999 Research Attainment

Publications

Attainment

Research in the areas of assessing the effects of urbanization on stream quality, the effects of forest fires on vegetation structure, and the effects of urbanization on the soil environment have been advanced. Research has advanced on how changes in stream water toxic loads, nutrients, temperature, and water flows, which are associated with changes in impervious cover (e.g., buildings, roads) within a watershed, negatively affect macro invertebrate populations (e.g., insects) in streams. These findings have important implications for management of watershed development to help improve water quality. Studies of regeneration after forest fires illustrate the importance of stand-replacing fires on the formation of canopy gaps, and the maintenance of habitat heterogeneity and species diversity. These findings can help affect forest fire management practices to attain desired forest structure and composition. Research evaluating the differences in nutrient uptake rates by seedlings, macro invertebrate populations, and litter quality along an urban-to-rural gradient give a better understanding as to how and why forest stand structure and functions are effected by urbanization processes.

4952 Structure and Function of Urban Forests NE-4952

Problem 2 Understand changes in energy, water, and pollutant flux associated with land use changes

FY1999 Research Attainment

Publications

Research Unit

Grant, R.H.; Heisler, G.M. 1999. The adaptation of UV forecasts to typical human environments: the UV shade index. In: Abstracts of the 27th annual meeting of the American Society of Phytobiology; 1999 JULY 10-15; Washington, DC. Photochemistry and Photobiology. 69: 56s. Presentation Abstract.

Grant, R.H.; Heisler, G.M.; Gao, W.; King, W. 1998. Multiple waveband solar irradiance in an open tree canopy: measurement and modeling. In: 23rd conference on agricultural & forest meteorology, 13th conference on biometeorolgy and aerobiology, and 2nd urban environment symposium; 1998 NOVEMBER 2-6; Albuquerque, NM. Boston, MA: American Meteorological Society: 202-205.

Heisler, Gordon M.; Wang, Yingjie. 1998. Semi-empirical modeling of spatial differences in below-canopy urban air temperature using GIS analysis of satellite images, on-site photography, and meteorological measurements. In: 23rd conference on agricultural & forest meteorology, 13th conference on biometeorology and aerobiology, and 2nd urban environment symposium; 1998 NOVEMBER 2-6; Albuquerque, NM. Boston, MA: American Meteorological Society: 206-209.

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Nowak, David J. 1998. Urban flora. In: Shumsky, Neil Larry, comp., ed. Encyclopedia of urban America: the cities and suburbs (volume 2). Santa Barbara, CA: ABC-CLIO: 819-821.

Cooperative

Nowak, David J.; Dwyer, John F.; Childs, Gina. 1998. Los beneficios y costos del enverdecimiento urbano [the benefits and costs of urban trees]. In: Krishnamurthy, L.; Nascimento, Jose Rente, comp., ed. Areas verdes urbanas en latinoamerica y el caribe. Chapingo, Mexico: Universidad Autonoma Chapingo, Centro de Agroforesteria para el Desarrollo Sostenible: 17-38.

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Extramural

Grimmond, C.S.B.; King, T.S.; Roth, M.; Oke, T.R. Aerodynamic roughness of urban areas derived from wind observations. Boundary-Layer Meteorology. 89: 1-24.

Grimmond, C.S.B.; Oke, T.R. 1999. Evapotranspiration rates in urban areas. In: Impacts of urban growth on surface water and groundwater quality: proceedings of the IUGG 99 symposium; 1999 JULY 18-30; Birmingham, UK. IAHS Publ. 259. [Place of publication unknown]: International Association of Hydrological Sciences: 235-243.

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4952 Structure and Function of Urban Forests NE-4952

Problem 2 Understand changes in energy, water, and pollutant flux associated with land use changes

FY1999 Research Attainment

Publications

Attainment

Significant progress continues to be made in quantifying and modeling the urban forest effects on particulate air pollution and ultraviolet radiation, and on modifying the urban atmosphere, particularly air temperatures. Analyses of numerous tree species reveal differences among the species in mass loading of particles on the leavesand differences in suitability of the leaves for automated scanning electron microscopy and X-ray microanalysis techniques. Findings can aid in proper species selection for removing particulate air pollution and in aiding researchers in analyzing tree leaf removal of particulate matter. An index was also developed to help assess the effect of urban tree shade on ultraviolet radiation reaching the ground, and allow humans to help gauge the level of their reduced risk of exposure to UV radiation (e.g., sun burn, skin cancer) in urban tree canopied environments. A three-dimensional radiation model was also developed to aid in the prediction of radiation (including ultraviolet radiation and long-wave radiation associated with heat stress) received by humans and other elements in the vicinity of trees in suburban environments.

Observations of urban morphology and the atmospheric environment has led to the development of an equation to predict differences in below canopy air temperatures across the diverse urban environment. This research can be used for a better understanding of how vegetation and various built surfaces (e.g., buildings, roads) affect air temperatures. Consequently, vegetation and city management plans can be developed to reduce air temperatures, and thereby affect energy use, human comfort, and human health. Measurements on the magnitude and variability of evapotranspiration rates have been made in seven cities. Knowledge of evapotranspiration rates are important for significant number of hydrologic and atmospheric issues, including water supply, water quality, flood runoff, and air temperatures. The measurement and modeling of urban forest effects will lead to better management plans to improve human health and environmental quality in and around urban areas.

PART II: BIBLIOGRAPHY

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Fiscal Year 1999

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